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AVIATION

The Oldest American Aeronautical Magazine

IN THIS ISSUE

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AVIATION

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THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

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WRIGHT CYCLONES
Selected to power
TWA
DOUGLAS AIRLINERS

217 MILES AN HOUR

A speed of 217 miles an hour at 9 000 feet altitude, a landing speed of less than 60 miles an hour and a passenger cabin quieter than a Pullman are features of the new TWA Douglas Luxury Airliners

240 MILES ON ONE ENGINE

At Winslow, Arizona (4 500 feet above sea level) the pilot deliberately shut off one engine when the plane had traveled 2,200 feet down the runway. The plane continued its take-off on one engine, climbed to 9,000 feet and flew to Albuquerque New Mexico—a distance of 240 miles—at an average speed of 120 m p h- on a single engine

CYCLONES DEVELOP 1430 H P.

The two supercharged Wright Cyclone Engines of the TWA Douglas Airliner develop 1430 h p at 9,000 feet altitude The enormous cabin of this modern transport offers the ultimate in luxury and comfort for fourteen passengers.

Transcontinental & Western Air's new, all-metal Douglas Airliners will be powered by Wright (Series F) Cyclones. These Luxury-Airliners, scheduled to be placed in service this spring on "The Lindbergh Line," will reduce TWA's flying time from coast to coast to less than 18 hours. This announcement is of commanding importance to the aeronautical world, because it represents the largest purchase of new equipment by any of the world's leading airlines.

TWA's technical staff selected Wright Cyclones after exhaustive tests which many experts in the aviation industry believed impossible to pass. One of these tests included a "single-engine" take-off, with a full load of 17,500 lbs., from Winslow, Arizona (4,500 feet above sea level). On this test the pilot deliberately shut off one engine when the plane had traveled 2,200 feet down the runway. The plane continued its take-off and climbed to an altitude of 9,000 feet, where the pilot leveled off and flew over the Continental Divide to Albuquerque, New Mexico—240 miles distant. A speed of 120 m.p.h., on one engine, was maintained throughout the flight.

High altitude tests were made around 20,000 feet to determine how the Wright Cyclones would function in the sub-stratosphere, in line with plans which are now being developed by TWA for the high altitude flying of the future. Other tests included a full-throttle climb from sea level to 20,000 feet in 24 minutes; and a one-engine climb, with full gross load, from 6,000 feet to 8,000 feet in 10 minutes.

More than 170 hours of flying time were required to make these gruelling tests, which indicates how thoroughly they were conducted by TWA's technical staff. The outstanding performance of the Wright Engines culminated in the decision to have the Douglas Airliners powered by Wright (Series F) Cyclones.

WRIGHT
AERONAUTICAL CORPORATION
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AVIATION
FOR FEBRUARY, 1934

It is the privilege of AVIATION to present a unique account of the 1933 survey flight of Col. and Mrs. Charles A. Lindbergh, written by Commander Weems and based on information furnished by Colonel and Mrs. Lindbergh. In the preparation of this material Commander Weems has also drawn on such sources as Pan American Airways, of which Colonel Lindbergh is technical advisor, and the American Museum of Natural History, to which the airplane and its equipment has been presented. The accompanying article is the first of two devoted to the subject. The second will appear in an early issue.

The Flight of The "Tingmissartoq"

The authoritative account of the 1933 survey flights of the Lindberghs

THE FIRST OF TWO ARTICLES

By Lt.-Comdr. P. V. H. Weems
U. S. N., Retired

THE transatlantic survey flight of Col. and Mrs. Charles A. Lindbergh, beginning July 9, and ending Dec. 19, 1933, represented not only an invaluable contribution to ocean flying knowledge but also a conclusive demonstration of the practicability of Atlantic flight. Thoughtful planning and careful selection of equipment coupled with ingenious application of previous experience in long distance flights made it possible to complete this 30,000-mile trip, embracing 21 countries and four continents, without incident although a wide range of flying conditions were encountered in the broad area bounded by the frigid wastes of Greenland and the tropical jungles of South America. The contribution made by radio and navigation was not unrequited, for these fields were enriched by valuable discoveries.

Few flying expeditions have been more completely outfitted and the quantity of equipment and the compactness with which it was stowed in the relatively narrow confines of the airplane was not far short of remarkable. No space was wasted and both floats and wings were put to work in carrying their share of the load. In addition to the necessarily large supply of fuel such items as a sledge, a rubber boat, a waterproofed auxiliary radio set, complete navigation equipment, one month's provisions, and many emergency devices, were carried and will be discussed in detail later. The inventory as well as the methods to be outlined in these articles should serve as a guide for future aerial explorations.

The flight was made primarily to learn as much as possible of the various routes which could be used for an air service between North America and Europe in connection with Colonel Lindbergh's position as technical advisor to Pan American Airways.

Steamship co-operation was furnished in the Labrador-Greenland-Iceland area by the Danish ship Jellinge which was under charter by Pan American Airways. Supplies were laid down by the Jellinge at Halifax, St. Johns, Cartwright, and in Greenland and Iceland. Radio communication was maintained with the Jellinge from the time the plane left North Haven, Me., until it finally neared Europe, weeks later.

The "Tingmissartoq"

"Tingmissartoq," which in Greenland Esquimo language means "The man who flies like a big bird," was the name given to the Lockheed Sirius monoplane, powered with a Wright Cyclone SR-1820-F2 direct drive engine rated 710 hp. at 1 900 r.p.m. During the flight the engine was operated at an average speed of 1,425 r.p.m. giving a cruising speed of 103 knots or 118 m.p.h. Fuel consumption at the above

cruising speed was 25 gal. per hour, but on certain stretches, such as the trans-Atlantic crossing, the cruising speed was reduced to 1,350-1,390 r.p.m., and the fuel consumption dropped to 21 m.p.h. The range of the ship in still air, with the 440-gal. fuel capacity was about 2,100 miles at 118 m.p.h. The sea level top speed of the ship was approximately 185 m.p.h. and its normal cruising speed 150 m.p.h. at 1,700 r.p.m.

Weight data released with Colonel Lindbergh's permission by the Edo Aircraft Corporation, after weighing the ship on its return from the trip determined the actual weight empty including equipment, as 4,589 lb. The weight of the occupants was given as 280 lb., while miscellaneous baggage was 75 lb., oil 150 lb., and gasoline 2,653 lb., totaling 7,699 lb. gross. Included in the above weight empty was 300 lb. of equipment, such as instruments, radio battery, starter, bringing the true weight empty down to 4,289 lb., giving a useful load of 3,410 lb., or 44.3 per cent. The wing span was 43 ft. and the area 265 sq.ft., giving a wing loading of 29 lb. per sq.ft. and a power loading of 10.85 lb. per hp.

The propeller was a Hamilton-Standard controllable pitch type with a diameter of 10 ft. and blade settings ranging from 18½ to 22½ deg. Floats were standard Edo Model 6075 fitted with special gasoline tanks having a capacity of 160-gal. each, the remaining 120 gal. being carried in the wing tanks. The floats were normally rated for a maximum gross weight of 6,400 lb. at 90 per cent reserve buoyancy. They had a total submerged displacement each of 6,075 lb. The reserve displacement was 58 per cent.

Equipment

Since the flight covered a range of latitude from south of the equator to above 73 deg. North, including long over water hops and the crossing of the formidable Greenland ice cap, it was necessary to carry a large and varied supply of special equipment. The drawing of two views of the plane shows the position of the more important instruments, and the manner in which the equipment was stowed.

The rubber boat was equipped with a sail, oars, a 12-ft. mast and a 3¾-ft. boom, drinking water, food for one month, and a rubber cover to keep the personnel and equipment dry. Boats of this type are surprisingly efficient and safe. They are inflated by two hand pumps and are of ample buoyancy and capacity. A service test was given one of them by a navy pilot who spent five days on it in the Pacific Ocean near Panama after a forced landing a short time ago.

Not only did the outfit include the obvious arctic clothing such as Kamiks, mittens and winter helmets, but it also included equipment to be used in case of a forced landing in an uninhabited place. The month's supply of food, a rifle, pistol, ammunition, fishing gear and so on, were to be carried in a snow sledge weighing 49½ lb. and 130 in. long—nearly 11 ft. This sledge was carried in the plane partially disassembled, and the parts were designed so that they could be lashed together with leather thongs when required.

For travel over soft snow, arctic snow shoes were carried, while for travel over glassy and sloping ice as in the crevassed area of the Greenland ice cap, steel crampons which strap to the shoe were provided.

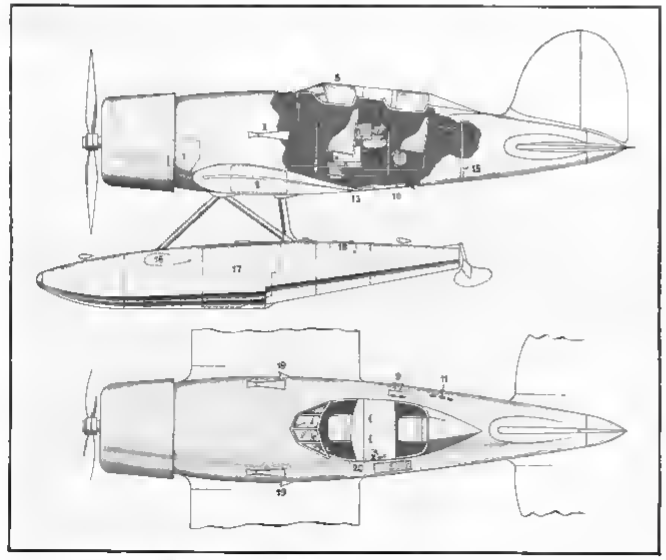
The tremendous amount of detailed work and training necessary for their collection and the proper use of the flight equipment may be appreciated by viewing the eleven cases of material in the museum ranging from an outboard motor, to fish hooks.

If it becomes necessary to abandon the plane the auxiliary radio set is placed in the rubber boat along with other emergency and navigation equipment.

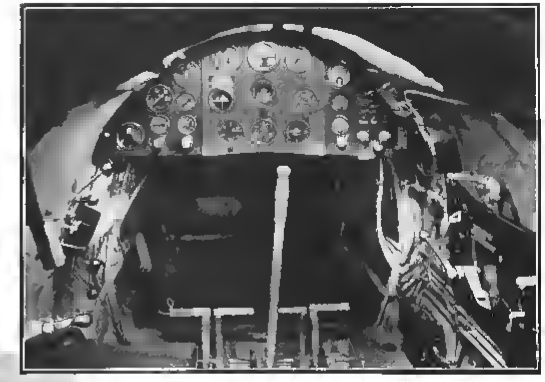
Many disapproved of the long over-water flights because of the danger, yet when consideration is given the careful preparation, thorough training, and efficient equipment, it will be found that the expedition cannot be called a hazardous enterprise. To be sure strenuous work was encountered—plent of it yet the actual risks were reduced to a minimum.

Water recovery device

One unique safety device will surprise and interest many people. It would add a considerable extra weight if a full water supply were included. In most cases water would be available in the form of ice, snow or rain water. On the other hand, if forced down on the desert coast of Africa, for example, or if adrift on the ocean and no convenient rain replenished the water supply, this deficiency might be fatal. To provide an additional factor against this possibility of water shortage, two water recovery devices were included. These work on the same principle as the apparatus used in airships to reclaim moisture by condensation from the engine exhaust gas, the moisture from the human breath being condensed to eke out the failing water supply.



Layout of the Tingmissartoq: 1, Oil tank (28 gal.); 2, Wing gasoline tank (60 gal.); 3, Venturi tube for operating gyro horizon and directional gyro; 4, Instrument panel (see photograph on page 35); 5, Transparent sliding hatch; 6, Main radio receiver; 7, Main radio transmitter; 8, Maps and charts; 9, Gatty ground speed and drift meter; 10, Radio antenna and reel; 11, Parachute flares; 12, Aperiodic compass; 13, Battery; 14, Storage space for portable boat, outboard motor, rifle, etc.; 15, Loop, for radio direction finder; 16, Airfoil surface between floats; 17, Float gasoline tank (160 gal.); 18, Compartment for 75-lb. anchor; 19, Vent; 20, Stabilizer adjusting devices.



Below: The radio transmitting key was mounted just above the receiving set and the Gatty ground speed and drift meter (right) was placed behind the radio receiver on the starboard side of the ship.

Above: The instrument board, blind flying instruments including the artificial horizon and directional gyro were mounted on the center panel, power plant instruments on the left, and electrical and miscellaneous indicators on the right.

Panel instruments

The plane was equipped with the usual panel instruments of the latest type including a standard 3 in., aperiodic, magnetic compass, mounted between the front and rear cockpits on the right side so that it could be used from either cockpit. A second smaller spherical magnetic compass was mounted on left side of the dashboard for emergency use and as a check on the aperiodic. Complete rehance was placed in the directional gyro which proved to be a great improvement over the magnetic compass for steering, particularly in high latitudes near the magnetic pole where the variation changed rapidly and where the magnetic directive force was weak. Although the directional gyro was used continuously for steering, it was set to conform to the magnetic compass at intervals of from twenty minutes to two hours. Ordinarily the directional gyro was checked against the magnetic compass (but not reset) every ten or fifteen minutes.

When steering by the magnetic compass, over snow or water near the magnetic poles, the compass swings back and forth without the pilot being able to detect it and since the pilot tends to follow the compass, the plane is steered on a series of curving courses. When steering by the directional gyro, a steady course may be followed permitting the magnetic compass to settle down so it may be used as a reliable means for setting the directional gyro. While the latter may be used to steer a steady course, it gradually creeps off and must be reset; it is not directive in itself but merely holds for a limited time the course to which it is set.

The air speed meter gave accurate results except where the pilot static tubes became filled with water during very heavy rains. At these times it was necessary to blow the water out after which the instrument again functioned satisfactorily. The gyro horizon was used on several occasions and gave excellent results.

Charts and maps

There is no single source of supply of all the charts and maps required for such a flight as this. They were furnished by the Hydrographic Office the British Admiralty, Rand McNally & Company, the Canadian Government and the civil and military aviation organizations in practically every country visited. The charts furnished by Dr. Vilhjalmur Stefansson technical advisor to Pan American Airways were especially helpful on the flights in high northern latitudes. Except for high latitudes around Greenland, the Hydrographic Office charts on the Mercator projection, as used by the mariner, proved the most satisfactory. In low latitudes where the longest over-water flights were made, the rhumb line course given by a straight line on the Mercator chart was not only more convenient to steer, but it was sufficiently close to the great circle course for practical purposes. On the flight across Greenland, where it pays to follow the great circle course for distances as short as 500 miles, a Canadian Government equidistant map was used with excellent results. On this map, constructed on the conical orthomorphic projection a straight line closely approximated the great circle course. The scale provided is correct for latitudes 47 deg. N. and 63 deg. N. and the errors remain under 3 per cent from latitudes 40 deg. to 70 deg. N. A table for correcting these errors is included. This excellent map of the "North Atlantic Ocean with Adjacent Countries" was produced by the Department of Interior, Ottawa, to "facilitate the study of aerial routes between Canada and Europe." (See "Trans-Atlantic Air Lanes," by Roger O. Williams, AVIATION, July, 1933.)

For dead reckoning

In addition to the compasses, directional gyro and panel instruments, the following special dead reckoning equipment was carried: The Gatty ground speed and drift indicator; protractor; slide rule, charts and maps.

The Gatty instrument was considered the best available ground speed and drift indicator. Mrs. Lindbergh made the ground speed and drift observations and was able to do so over the Greenland ice cap as well as over water, and over land. Since the plane was not on a fixed schedule and, when committed to

a flight it was usually necessary to complete it regardless of the speed made good or the time consumed, the ground speed was not as important as the drift. The drift feature of the device was highly satisfactory and drift observations were made regularly.

Under average weather conditions over water the drift could be estimated by a trained water pilot nearly as closely as it could be measured; in fact, the drift was first set by estimate and later checked by drift observations. During the entire flight practically no changes were made in the courses originally set by dead reckoning.

Since the ground speed as determined by the Gatty instrument depends on the altitude, it was of course necessary to obtain the altitude *above the surface*, accurately. This was difficult. In such a case, it was necessary to fly low, note the altimeter reading, gain altitude, and use the difference of altitude, in making the ground speed observation. The slide rule was available for reducing the work of making tedious calculations. Actually the navigation during the flight was not hurried. As Lindbergh states, "there was all the time in the world" for navigation, with the result that most speed-time-distance problems were done with pencil and paper. In fact, a considerable portion of the dead reckoning computations was made before taking off on each leg of the flight.

Radio equipment

Both radio sets were developed by the Pan American Airways. The main set, which was also used on the 1931 flight, weighs 62 lb. installed, and gave phenomenal results. It was never out of commission on the Orient flight in 1931, and was out only for a short time while over Baffin Land in the 1933 flight when the dynamo stuck. It was put in order within a few minutes after the landing.

While it is possible to receive ordinary radio broadcast in English, all sending had to be done by code. Mrs. Lindbergh did all the sending and receiving which constituted an important part of her duties.

The regular set included a directional loop in the fuselage with which to take radio bearings. The loop was installed before the flight to the Orient, and was not designed for accurate work. Fairly accurate results were obtained, however, when receiving signals from a powerful station at close range. The directional loop, although not used frequently, is extremely important when properly installed. The type required is adjustable, permitting a bearing to be taken without swinging the ship off its course. With the fixed loop used it is necessary to swing off the course to get accurate bearings, and this is undesirable for several reasons. Time is lost and the dead reckoning is seriously complicated. On the other hand the movable loop must be mounted on the outside for metal planes and this increases the drag.

The transmitter's master oscillator is the power amplifier type using one UX-210 as the master oscillator tube and one 210 unit in the power amplifier stage. The set is arranged with plug-in coils to operate on any one of six frequencies from 12,240 to 333 kc. Transmitter power is obtained from a small dynamotor operated from the 12-volt storage battery and delivers 600 volts at 200 milliamperes for the plate supply. Filament power for the tubes is obtained directly from the storage battery for both receiver and transmitter filaments. A regular aircraft "B" battery is used for the receiver plate supply.

The receiver consists of one stage of audio frequency amplification regenerative detector and two stages of audio amplification. Plug in coils are provided covering the frequency band from 15 to 150 meters and from 550 to 1,100 meters.

The direction finder consists of approximately fifteen turns of insulated wire secured directly to the inner face of the fuselage thereby forming a fixed loop approximately 30 in. in diameter. A loop tuning unit is provided to go ahead of the regular receiver.

Auxiliary radio set

This auxiliary set was of 3½ watt capacity, water-tight, and weighed 44 pound. It consisted of both transmitter and receiver, operating by battery on two frequencies and was completely self-contained. This set was designed and built under the direction of Mr. Hugo Leuteritz, communications engineer, of Pan American Airways. It measures about 18x18x18 in. and could have been taken from the plane for use in the rubber boat or carried with the sledge in case of a forced landing. This set has a range of about 150 miles in the daytime and nearly 1,200 miles at night.

It was developed originally by the Pan American Airways for use in case of forced landings in the South American jungles. For the further extension of its use, it was made water-proof and as nearly shock-proof as possible. In the course of rigid tests it has been dropped 18 ft. on concrete and then operated at a range of 300 miles; it was submerged under water for 24 hours, then hoisted out and found to be in working condition.

The portable radio set may be dropped by parachute to a party in the jungle, or in a boat. In this way relief may be provided when it is not possible to land a plane to render assistance. A party carrying this set may thus be guided through an unknown jungle.

Log of the "Tingmissartoq"

July	Mileage		Aug	Mileage		Oct.	Mileage	
3	350	New York to South Warren, Me. (near North Haven)	5	150	Ella Island to Clavering Island	27	300	To Paris.
			7	350	To Angmagssalik.	Nov		
11	350	To Halifax, N. S.	8	460	To Godthaab.	2	270	To Amsterdam.
12	350	To St. Johns, N. F.	8	350	To Julianehaab.	8	400	To Geneva.
14	510	To Cartwright, Labrador.	12	350	To Angmagssalik.	11	350	To Santona, Spain.
17	260	Over Northwest River—exploration.	15	700	To Reykjavik Iceland.	13	250	To Caldelas de Tuy (Vigo).
			22	350	To North, East, South coasts of Iceland.	18	350	To Lisbon.
21	300	Cartwright to Hopedale, Labrador (indirect).				21	1 020	To Horta Azores.
			23	348	Iceland to Faroe Islands.	23	160	To Ponta Delgada, Azores.
21	200	To Hebron, Labrador.	24	200	To Shetland Islands.	24	1,100	To Las Palmas, Canary Island.
23	350	To Gothaab, Greenland.	26	350	To Copenhagen.	26	300	To Villa Cisneros Africa.
26	350	To Holstenborg, Greenland (via Mt. Evans).	Sept			27	700	To Porto Praia, Cape Verde.
			4	345	To Stockholm.	30	400	To Bathurst Gambia.
27	300	Holstenborg to Mt. Evans over Inland Ice.	20	350	To Helsingfors, Finland.	Dec		
			22	200	To Leningrad Russia.	3	1,334	To Natal Brazil.
60	300	Holstenborg to Lat. 70 deg. 15 min. N. and return.	25	400	To Moscow.	3	1 004	To Para Brazil.
			29	350	To Tallinn, Estonia.	8	350	To Manaos Brazil.
Aug.			Oct.			12	350	To Port of Spain, Trinidad.
3	350	Holstenborg to Baffin Land and return.	1	350	To Oslo, Norway.	14	752	To San Juan Porto Rico.
			3	200	To Stavinger.	13	350	To San Pedro de Macoris R. D.
4	1,200	Holstenborg over Greenland Ice Cap to Sorcraby Sund and Ella Island.	4	700	To Southampton, England.	18	961	To Miami, Fla.
			23	360	to Galway, Irish Free State.	18	350	To Charleston, S. C.
			29	450	To Inverness, Scotland.	13	600	To New York.

Enter the Federal Budget, Bringing a Mixture of Good News and Bad

Aviation and the Government's Spending

By Edward P. Warner

Editor of AVIATION

THE President's budget message to Congress and the 800 pages of tabulated figures that accompany it now appear just after the first of January each year.

Whether they have to be considered as a belated Christmas present, as slightly belated raw material for working up New Year's resolutions of economy and restraint, or as a premature April Fool's joke, depends on the figures and on the point of view. Last year the real practical joke appeared very near to April 1, for after the budget had been all prepared and analyzed, and after Congress had worked over the appropriation bills and passed them and seen them approved by the President, a new administration came in and tossed the whole works overboard with a series of instructions that the money that had been appropriated simply shouldn't be spent. Never before had a budget had so little relation to the actual policies of the fiscal year to follow. This year nothing of the sort is in prospect. President Roosevelt now has his own budget director and his own budget, and it may be assumed that his recommendations on appropriations and his prophecies on expenditure are very closely representative of the actual facts in prospect for the fiscal year 1935 (beginning on July 1, 1934, and continuing through June 30, 1935, the term in respect of which all governmental bookkeeping is done).

Confusion worse confounded

Last year's budget turned out to mean very little. This year's will mean much more, but in some cases the meaning is exceedingly difficult to extract. Never before has budget analysis been such a baffling problem. Last year's budget had called for total appropriations of $3,776,000,000 for the current fiscal year. By the time the new administration got through with its pruning and its administrative directions to withhold expenditures, the actual outlay to be charged against the normal appropriations for the fiscal year had been reduced by just one-third, to $2,531,000,000. Then, however, there were added new appropriations for public works, farm relief, and other new activities to a total of $6,852,000,000, and the expenditures under the new appropriations cut across practically every activity for which the old or regular estimates had been submitted. Thus, for example, the Secretaries of War and of the Navy were instructed not to spend a substantial part of the money that had been appropriated for purchase of new aircraft for the services, but then a grant was made from public works funds of $15,000,000 to buy new planes in place of those that would normally have been bought with the regular appropriations that were withheld. The whole picture has become indescribably confused, and for next year promises to be only a little less so, as the present budget carries an estimate of new emergency expenditures of $2,000,000,000 for the fiscal year 1935 without giving the slightest inkling of how, when, or where the money is to be applied.

I—Aircraft Purchases

PARTICULARLY complicated and troublesome are the sections that deal with the buying of new aircraft for the Army and Navy. The use of the device of "contract authorization," with a certain appropriation made in cash to be expended during the fiscal year to which the budget relates and with a further allowance for contracts to be placed during that year and paid for out of the funds actually appropriated in some succeeding one, has always created a substantial difference between the rate at which funds are obligated and the rate at which they are actually expended. This year the difference has become more indeterminate than usual, for a part of the 1934 contract authorization is to be allowed to drag over into the next fiscal year before the placing of the orders.

Of the $23,324,000 appropriated for the Air Corps for all purposes for the present fiscal year, less than one half is actually being expended. The remainder has been withheld by presidential direction, and practically all of the money impounded has been withdrawn from the allotments for the purchase of new aircraft and for experimental work. The prospect a year ago was that the purchase of new aircraft for the Air Corps from the regular appropriation for the fiscal year 1934 would be just over $11,000,000. Actually the obligations incurred for the present year are now estimated to total $2,475,000 for the procurement of standard airplanes and another $525,000 for spare engines. To that sum, however, must be added the Army's Public Works allotment of $7,500,000, all of which is proposed to be obligated before June 30 according to present estimates. Deducting the administration and transportation expenses, $7,394,000 will be available for the purchase of standard airplanes and engines. *Adding that to the allowance from the regular appropriation, the total for the present fiscal year comes to $10,394,000.*

For next year there is no definite promise of further Public Works funds, though with $357,000,000 out of the original $3,300,000,000 of Public Works money still to be allotted, and with an undefined $2,000,000,000 estimated as to be appropriated during the coming fiscal year with the probability that much of it will go for public works, there is at least a chance that the Air Corps will draw some further benefit from that source. In any event the regular Army appropriation has been restored to something like its former level. The estimate for obligations for new airplanes from that source, including the use of a $3,000,000 contract authorization, payments under which will not actually come due until a succeeding fiscal year, is $11,264,000 for purchase of standard airplanes and $2,107,000 for spare engines, or $13,371,000 in all. *The amount of cash that will actually pass into the hands of the industry in the form of final payments for new Army airplanes is estimated at $10,500,000 for the present fiscal year and $13,850,000 for the coming one, but on the whole this is a less satisfactory basis of record than is the listing of obligations incurred, or new contracts written.*

In considering War Department purchases of airplanes, it is necessary also to reckon with the National Guard and the organized Reserves, which are carried under separate headings in the appropriation bill. The estimates for the coming year make no specific allowance for National Guard airplanes, where

last year $775,000 was provided for the purpose For the Reserves there is a flat limitation to a maximum allowance for new airplanes of $308,000, as against $26,000 more than that a year ago However, very little of the current year's money is actually being spent.

Navy buying

The figures for the Navy are far more difficult to unscramble, being more deeply involved in changing contract authorizations There can be no strictly accurate apportionment of new obligations at the present time, and at best there is a certain amount of guesswork about the amount of spending that will be done in the current fiscal year and the amount that will be postponed until 1935 For the present fiscal year the cash payments and obligations against the current year's appropriation for new aircraft total $6,615,000 On top of that there was a contract authorization to be a charge against the appropriations of succeeding years of $8,100,000, but the indication of the figures in the present budget is that only $2,400,000 of that amount is actually being obligated during the present year. That would indicate a total expenditure for new naval aircraft under the regular appropriation of $9,015,000 To that must be added, as in the case of the army, the Public Works money A specific grant of $7,500,000 has been made for the purchase of new planes for replacement within the 1,000-plane program adopted by Congress in 1926 A certain portion has been turned to purposes of maintenance, but there remains for the actual purchase of aircraft $6,-114,000, all of which is expected to be obligated during the present fiscal year *The total of Navy obligations for new airplanes and engines in the fiscal year 1934 would then appear to be $15,-129,000.*

For the coming year there is uncertainty, as in the case of the Army, about the possibility of additional Public Works grants There should be a fair chance that they will be forthcoming. There are other uncertainties as well, and in particular confusion develops out of the incomplete use of the present year's contract authorization, since the navy's appropriation bills are so drawn that these contract authorizations remain good for two years If it be true, therefore, that only $2,400,000 of the current year's contract authorization is actually being obligated during 1934, the remainder, or $5,700,000, will remain available for the fiscal year 1935 That would be in addition to a cash appropriation of $3,731,000, the residue that will be left out of a $6,131,000 total after the $2,400,000 of hangover obligations from the use of this year's contract authorization shall have been met. There must he added also $2,800,000 of new contract obligations definitely provided in the new estimates for the coming year. Adding all these figures, it appears that the contracts to be newly written for new naval aircraft in the fiscal year 1935 should run to $12,231,000

$25,910,000 for new planes

Out of this incomparable tangle of figures there emerges a prospective total of contracts for new aircraft in 1935 according to the best estimates that can now be formulated of $25,910,000. That will be off about 3 per cent below the level of the present fiscal year, but well above the figure for 1933 We are still running about $5,000,000 a year below the average rate of procurement of the years from 1927 to 1932 and such a reduction is a little surprising in view of the present world political situation and of the extent to which recent innovations in military aircraft design have rendered all airplanes built prior to 1933 obsolete for use in air warfare.

Of the effect on the total amount of equipment in service and on the volume of operation, the explanatory statement prefacing the budget says merely that "Since the Air Corps can contract for the procurement of only about 94 new airplanes in 1934, it becomes necessary to provide for a greater number in 1935 to replace losses . . . with the amount estimated for appropriations for 1935 Provision is made for the procurement of 348 new airplanes, of which 333 are chargeable to the appropriation for the Air Corps and 15 to that of the organized Reserves." In addition to the 94 machines being bought this year from regular funds, the special Public Works allotment is estimated to provide for 100 combat airplanes, 46 bombers, and about 50 attack ships

There is no official estimate of the number of planes that will be on hand for the Army Air Corps at the end of the coming fiscal year The best independent estimate that we are able to formulate indicates that the total will probably run to about 1,520 "serviceable" machines some 450 of which will be of tactical types and strictly modern) to hand on June 30, 1935 *There will still be a deficiency of about 125 planes as compared with the number called for in a "Five-year program" which will then be over nine years old, and which will never at any time have reached within 100 machines of its original goal and in the last three years will have made no progress at all. That state of affairs ought to speak for itself There should be no need of further argument in favor of an accelerated provision for the modernization and increase of Air Corps equipment The Navy will not be quite so badly off for the Navy reached its five-year goal within the time set and has approximately maintained the same level ever since but there has still been no provision for planes to equip new ships built in the last four years, including even the aircraft carrier Ranger,—now nearing completion*

No less important than the purchase of standard aircraft for the Army and Navy is the continuation of experiments and of the development of "improved types. During the present year experimental work has suffered grievously in the Air Corps, for although it was possible to maintain the personnel at Wright Field without substantial reduction, the amount of money for experimental and development work, including the purchase of new articles for trial on experimental contracts, was cut from $1,139,000 to $318,000 The budget estimates provide a restoration of both items substantially to their 1933 level for next year, with a total of $2,843,000 for all experimental work and $1,149,000 of that amount to be spent on experimental contracts and the purchase of equipment and supplies In the Navy no such severe restriction has been placed upon expenditures during 1934. They were cut only about 11 per cent from the 1933 level, and for next year they remain substantially on a par with current figures In particular, $700,000 is to be available for purchase of experimental airplanes, $366,000 for engine development, and $165,000 for engine accessories and fuel,—all three figures slightly increased over 1934

II—Air Transportation and Civil Aircraft Operation

THE Army and Navy are no more important to the builders of aircraft than the Post Office to the operators Last year the budget had promised a $20,000,000 allotment for the handling of domestic air mail by air transport lines, but the two houses of Congress and the new budget director of the new administration each successively took a crack at that sum and lowered it progressively to nineteen million dollars to fifteen, and finally to fourteen For next year there seemed to be good reason to hope that the trend would be reversed and the air mail appropriation increased, and the editor of AVIATION in his prophecy of last month predicted a boost at least of $17,000 000 On the face of the present returns that was a little too optimistic

The estimate for 1935 is for $14,-995,000, still far below the level of any previous year since 1930 except 1934, but good enough to offer at least a hope that transport companies will feel justified in keeping all their present services alive and maintaining their present schedules Should there be no change in mail runs in the next eighteen months the average payment per mile flown in domestic service in 1934 will be 40 cents as against an average of 57 cents a mile in the calendar year 1932 and of 35 cents a mile (which inevitably means heavy losses for most of the operators under present conditions) over the last three months of 1933 If Congress expects to have any new air mail routes inaugurated or to secure air mail service over the northern transcontinental airway or any of the other airways that are now being built with Public Works funds, Congress will have to do better by the air mail than Budget Director Douglas has done

"Subsidies"

As for four years past, the allowance for foreign air mail remains fixed at $7,000,000 Both for the foreign and for the domestic services, the appropriations are set up in a new fashion for 1935 Each item is divided into two parts, one alleged to represent the income to the government from postage on air mail, the other explicitly listed as a "subsidy to contractors" On the domestic mail the estimate is that postal income is to be $6,500,000, or 43 per cent of the total appropriation The remainder, $8,400 000 after administrative expenses are deducted, is classed as a subsidy For the foreign air mail $1,250,000 is taken as the cost of transportation and $5,750,000 as the subsidy Both figures for postal revenues and prospects seem extremely conservative

While on the subject of subsidies, it is worth noting that the same method of classification is now being applied to the ocean mail estimate, with the "cost of transportation" taken as equal to the amount for which the mail could be transported in foreign-flag vessels and the remainder of the appropriation classed as a subsidy On that basis which is on the whole somewhat more generous to the operating companies than is the one used in evaluating air transport subsidies, the cost of ocean mail transportation is $3 225 000 and the subsidy $28 000 000 *The subsidy for the merchant marine, in other words, is almost exactly twice that for all airlines, foreign and domestic taken together*

While on the topic of subsidies also since it is the subject of so much reckless statement and since the word is so often carelessly used, it is worthy of note that the difference between the payments to the railroads for carrying the bulkier classes of mail matter and the amount received in postage on such mail matter has not been separated out for listing as a "subsidy to railroads"

Checking ceiling and visibility

The support of American air transport by the government involves a triple alliance of Post-Office Department to provide a good share of the cargo, Department of Commerce to provide the airways and Department of Agriculture to provide the weather For the coming year the Weather Bureau's airways service will continue on approximately the same level as at present though with about 15 per cent fewer observers than were enrolled a year ago The actual estimate is for an appropriation of $1,081 000 with more than 90 per cent of that amount directly applied along the airways and the remainder devoted to research and to surveys. Though this might easily be much worse, still it is a little disturbing to find the service being reduced to below the 1932 level, especially as the growing importance of the air mass type of forecasting is likely to throw new burdens upon the bureau over the next two or three years and to require the addition of new personnel of very specialized training if the switch to new forecasting methods is to be smoothly accomplished

Airways and airworthiness

On return to the Department of Commerce we again begin to run into the complication of a mixture of regular and emergency appropriations The regular allowances for air navigation facilities seemed to have been cut very heavily in last year's budget, and AVIATION's budget analysis for 1934 was full of lamentation on that account. When the new administration moved in, the aeronautical world saw how deep a cut could really be A rate of expenditure that had run to over $8,500,000 in the fiscal year 1932 came down to just under six million dollars in 1933 and to approximately $4,500 000 each for the current year and for the year to come On top of that there have been a number of grants from Public Works totaling approximately half a million dollars for improvement of existing facilities and for relocation of badly placed lights with further allowances for the construction of a number of additional links of airway How the new airways are to be operated after they have been constructed remains to be seen, for already the length of lighted airway has had to be reduced by about 10 per cent in order to stay within the available amount of money

The outlay on air regulation has undergone even more spectacular reduction A year ago it appeared quite impossible to keep the cost there to under a million dollars a year, and money was transferred from air navigation facilities to regulation when a drop to below the million-dollar mark seemed to be threatened During the present year the Department is getting along on less than $700 000 and for next year despite the effect of an anticipated 5 per cent pay increase the budget is allowing only $644 100 The clerical force in Washington and the inspection force in the field are both to be reduced to about 10 per cent below the average level for the present year In particular it is planned that the number of general aeronautical inspectors shall be reduced from 42 a year ago to 28 next year and the airplane inspectors from 11 to 8 Airline maintenance on the other hand, will have the special attention of seven men instead of four, as in the past. There is no direct allowance for new airplanes, but there are likely to be Public Works allotments for that purpose for Commerce as well as for War and Navy Already the Aeronautics Branch has secured half a million dollars that came too late to be included in the printed book of the budget, for developing a low-priced plane for quantity production, and no doubt there will be more to come for commercial aeronautical projects out of the $2,000,000,000 of emergency money not yet specified or defined, but nevertheless anticipated in some form for allotment during the next fiscal year

Of the independent offices outside the regular departments, the only one of particular aeronautical interests is the National Advisory Committee for Aeronautics, focal point of all governmental research and medium of exchange among all departments and branches. The estimates for next year provide $708,000, which will permit almost exactly the same amount of work and the maintenance of the same organization as in the past three years As usual, about 60 per cent of the total goes for work in aerodynamics some 15 per cent for aircraft engine research, and the remainder to a wide range of miscellaneous activities and administrative accounts including the maintenence of a very comprehensive intelligence service and a European office. A public works allotment of $248,000, made during the past autumn, is being used for a variety of improvements to buildings and also for a number of pieces of entirely new equipment, including a new engine research laboratory, a vertical tunnel for the study of freely-spinning models (like the one at the British Royal Aircraft Establishment), and a new super-high speed wind tunnel of 24-in diameter. With all that completed there will be no important piece of aerodynamic test equipment that will be lacking at Langley Field and there will be no class of aerodynamic study that the Advisory Committee will not be prepared to prosecute

On the whole the budget cannot be very severely criticised from the aeronautical point of view There are a number of points at which we might have wished for a greater liberality but there are only two or three that are definitely disturbing Congress ought to examine the allowance for new aircraft for the Army and Navy very carefully and critically in connection with the current situation in world affairs when those appropriation bills come up for consideration and Congress no doubt will. A domestic air mail allotment of only $15,000,000 will undoubtedly be a real handicap to the development of air transport though not a fatal one

There has been vast confusion of thought within the industry regarding the interest of the Department of Commerce in the private airplane market and the policies behind the development of the low-priced airplane. In response to our request, Eugene L. Vidal, originator of the plan, has prepared an official and authoritative expression on a much misunderstood subject.

Eugene L. Vidal

Low-Priced Airplane

By Eugene L. Vidal

Director of Aeronautics, U. S. Department of Commerce

PRIVATE FLYING, measured in terms of active pilots, planes, and their use is on the decline.

After fifteen years or so of the building of planes for miscellaneous flying, there are less than 7,000 licensed airplanes in this country of 120,000,000 people.

It might be well to assume that there may be something wrong with the product which we now are attempting to sell, that the market exists for something different. It also might be well to overlook entirely the attitude of the pilots who already have learned to fly (who would like to have a faster plane) and concentrate on the average American citizen who may not be an aviation enthusiast. Also it might be well to cease planning planes which the industry feels that the future pilot should have and plan one which would appeal to the United States citizen even though it may not be as desirable to every pilot and designer.

The most important detail of an airplane, as of any other manufactured product, is its price. Granted an airplane should be safe, no matter how safe it may be, it cannot be sold in numbers if it is too expensive. It is useless to make a plane safe if it won't be purchased, and thus won't be flown. The majority of Americans buy automobiles which sell for less than $1,000 and are inexpensive to operate and maintain. They are quite accustomed to the price range between $500 and $1,000, and it goes without saying that an airplane for that price, sold on the installment plan, would have a popular appeal.

The automobile driver—and he is our customer—has become accustomed to other details of an automobile, its appearance, material, control, etc. A car made out of fabric couldn't possibly sell in these days. The metal machine is durable and strong. So should the airplane be.

Metal construction is desirable from many other viewpoints. Production methods originated for the automotive industries can be adapted to airplane manufacturing. Many of the parts can be stamped out of sheet metal, and others can be machined in large quantities. Technique of assembly and of maintenance and repair as developed for automobiles will suggest methods for volume-production airplanes, and these practices will have the advantages of ready adaptability and proved worth as to fundamental principles.

In appearance, the aircraft must be attractive, and in as many of its small details as possible should remind the car driver of his automobile. Appearance involves another important consideration. The volume production airplane certainly should look like an airplane, and not be a radical departure from what the average person expects to see along the airways. If a low-wing airplane becomes the large-scale production type, it will have the advantage of looking like the transport craft with which airline travelers already are familiar. To the casual eye the small airplane would appear as a scaled down reproduction of the airliners which now are flying, or will shortly be introduced on many of the scheduled passenger routes. And that is just what it would be, except that the small airplane would be far simpler, with fewer instruments, with fewer parts likely to require replacement, and with little professional training and skill necessary to fly it.

How many dials?

Without this simplicity there cannot be a successful low-priced airplane. A multiplicity of instruments would increase cost, and a complicated array of dials would discourage prospects from purchasing aircraft and learning to fly. On a transport craft which must adhere to definite schedules flying at night and in weather which makes air navigation difficult, the comprehensive instrument board is a necessity. For pleasure craft, the dials need be no more numerous than those for a low-priced automobile.

The same principle of simplicity applies in all matters of design. If any part can be eliminated, it means the elimination of several thousand pieces in production, and many thousands of operations in assembly. This can be accomplished with all proper regard for safety. We may bear in mind that this airplane is not intended to appeal primarily to persons who already are pilots, although many licensed pilots have indicated that they will be interested in it. If the market were to be among the pilots of the present day, high speed would be a primary objective. But the craft contemplated is one which will enable other persons to enjoy the pleasures and conveniences of flying, and it will therefore be possible to make some sacrifice in speed for landing safety in order to keep down the costs.

Volume production will produce an automatic lowering of incidental costs. With a vast increase in the number of airplanes produced, the price of engines will be lowered. The thousands of additional airplane owners in the market for accessories, insurance, gasoline, replacements, repairs and hangar space, will make possible a reduction in prices for such products and services. Manufacturers of the more expensive planes will benefit by the drop in prices.

All of these factors had been considered when the low-priced airplane project was announced. However, before any definite steps could be taken to make such an airplane a reality, it was necessary to have some indication as to whether or not it actually could be sold, and the project therefore began with a survey of the potential market.

Although the production type of airplane is meant to appeal more to the average man than to the person who already flies, those already licensed were our best contacts for obtaining market information, because they represent a group which is now known to be interested in flying. We were interested, therefore, in knowing how many of them would accept such an airplane, as this would give definite information as to an existing market and, what was more important, some indication as to the reaction which might be expected from the general public.

Replies to the memorandum were most gratifying. About 18,000 replied and 13,000 said they would purchase. The 13,000 affirmative replies included nearly 10,000 saying yes without reservations and about 3,000 making final decision conditional upon future financial status, approval of final design or other considerations. About 5,000 said they would not purchase. Persons to whom the memorandum was addressed were requested also to give the number of their friends or acquaintances who would be probable purchasers. The total number mentioned in this category was about 57,000. Surely one in ten of this group is an assured purchaser.

To assist in the development of the volume production low-priced airplane, the Public Works Administration has allotted to the Department of Commerce a fund of $500,000. The development and tooling necessary should not total more than this amount. How this money can best be employed to accomplish the desired objective is the problem which now is in the hands of a special committee authorized by Secretary of Commerce Daniel C. Roper, who from the start vigorously fostered the plan.

Operating under the ex-officio chairmanship of Ewing Y. Mitchell, Assistant Secretary of Commerce, the committee includes leading figures in the aeronautical world and representatives of all of the industrial and professional and sporting organizations most actively concerned with airplane market development or private flying promotion.

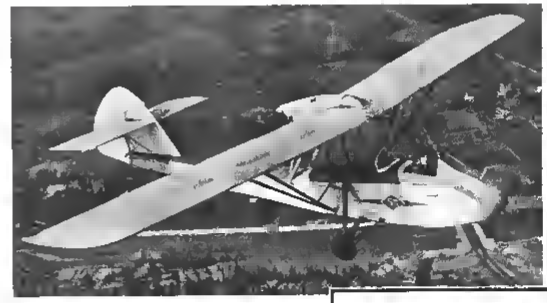
The committee is working on a program under which the industry can obtain mass production of low-priced airplanes without the usual sale risk and at the same time make certain that present builders of private airplanes will benefit from the project. It also will report on the design of airplane and engine, and will suggest methods of promotion. A technical committee, making a special survey of engines, consists of Luther Harris, John H. Geisse, and Richard C. Galey, all of the Aeronautics Branch.

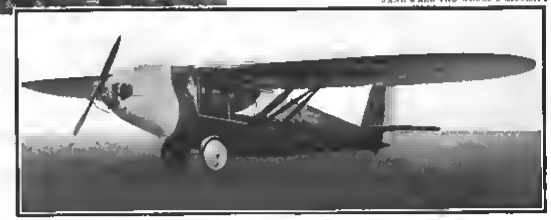
A number of aircraft manufacturers have assured us of their desire to proceed with plans for the low-priced airplanes, and these manufacturers are considering methods by which all can benefit by such a production program.

When the low-priced airplane becomes a reality, the future owners of these aircraft will reap the benefits of another Aeronautics Branch project, the development of airports and landing fields throughout the country. As this is written, about 70,000 men are working on some 700 locations, about half of the sites being new airports and the others established airports at which improvements are being effected. This work was made possible by the decision of the Civil Works Administration to approve the use of CWA labor on airport projects where the land is either owned or leased by the city. The program, which is primarily a private flying project for the smaller cities, is by no means completely drawn up. All of the 48 states have started, but the final total of new and improved fields will be considerably more than the total already approved.

These airports will increase the usefulness of airplanes, and make it easier for the industry to sell low priced craft.

An airplane can be built for $700, and the Public Works allotment assures that difficulties in the way of initiating the program can be met. Volume production will make the airplane possible, and it also will react to the benefit of the entire industry, stimulating employment in factories, increasing the business of airports, affording new opportunities for employment of pilots and mechanics. Indirectly, the renewed interest in flying undoubtedly will direct attention of more people upon the services offered by the scheduled airlines. There should be a development analogous to that which has taken place in the automobile, radio, refrigerator and other industries. And just as the introduction of these articles has been a stimulus to business in general, the low priced airplane has an opportunity to add to the scope of commercial activities.





JANE'S ALL THE WORLD'S AIRCRAFT

Foreign Light Planes. Above: The British A.S.I. two place pusher monoplane with Hirth 70 hp. inverted engine bears some resemblance to the Curtiss Junior, representing the open cockpit parasol type. Right: The enclosed variety of light plane is exemplified by the two-passenger Moller G.M.G. V (40-hp. Argus engine), in Germany.

Left: The Farman F.321 is a French example of the low-powered, two passenger machine. It is available with several power plants one of which is the 40-hp. Salmson engine.

In the race to increase performance of engines and airplanes, cruising speed, the actual criterion of airplane operation, has never been satisfactorily defined. An exhaustive study of cruising conditions for efficient operation has been made in the course of test flights of the new Douglas Transport. The results and the general conclusions that have been reached will be the subject of a series of articles to which this constitutes the introduction. The authors are the men who did the work,—Edmund T. Allen as consulting test pilot and W. Bailey Oswald in his connection with the Douglas engineering staff.

Operation at Desired Cruising Conditions

By Edmund T. Allen and W. Bailey Oswald

THE principal problems of flying, viewed as transportation, remain today as they have been for more than a decade those of speed, safety, economy, and comfort. With slightly varying emphasis they apply equally to military, commercial, and private flying. Even the pursuit pilot in time of war, to some degree at least, must have all these four problems solved for him. Without speed he is helpless to accomplish his mission in competition with swift enemies; without safety he will fail in too large a percentage of his attempts to reach his objective; without economy his range of action is too limited in comparison with more economical operation, and without comfort his personal efficiency is lowered. For the air commuter or the future trans-Atlantic air passenger, the differences in weighing these four factors are but slight.

Speed as a fetish

But the single problem of speed has to many aeronautical engineers appeared to be the most insistent, and it has indeed, become a kind of cult. To some it has seemed that speed stood out against all other factors; it has seemed that one could not have speed together with safety, economy, and comfort. Even when this was stated in such evident hastiness many of the speed enthusiasts were still uncritical.

There is a geographical line of demarkation between the more conservative group and the speed enthusiasts. The East Coast operators were in distinct opposition to those of the "great open spaces." They hardly realized that in the East it was their frequent stops, cutting down even the fastest transports to slow schedules, that influenced their preferences. Nor did they realize that it was their small intermediate and emergency landing fields that led them to prefer low wing loadings. They were not saturated with the bitter competition over long routes where small differences in cruising speed appeared as large discrepancies in arrival time at a destination half a continent away.

The enthusiasts for speed were often equally one-sided. They did not see that it was unnecessary to sacrifice safety, economy, and comfort in so headlong a fashion,—that any sacrifice whatever of these three factors was a partial defeat.

Neither side of the speed controversy realized fully that "high" or maximum speed of an airplane is not the speed that can interest anyone who is concerned with air transportation. Maximum speed is the will o' the wisp, that has ever led us astray, until, after our dreams of swiftness have sunk in operation to the rational block-to-block cruising speeds, we awake to find ourselves bogged down with the same old slow schedules.

Virtually all transport operation is carried out at cruising power. Of what concern to us then is "high speed"? Why even measure it? Why is it specified? Our problem is to get the best block-to-block speed, and cruising speed is its prime factor.

Safety as a problem must be weighted along with speed. Since this is true in general for all forms of travel, air travel cannot remain an exception. A given airplane is slightly safer against engine failure when cruising at 50 per cent power than at 70 per cent power. Between a slow and a fast airplane, however, this relationship does not necessarily follow because of the many factors aside from cruising speed that affect safety. For safety is achieved more consistently by intelligent operation in any case than it is by the simple demand for flying "low and slow." Intelligent operation includes control of cruising conditions according to scientific principles rather than to dogma, to prejudice, or to habit.

Economy in transport

Economy as an air transportation problem is one that touches all types of flying, except perhaps racing, and it affects them radically. Much has been written about the economy of transport operation, but the analysis of cruising costs has not been gone into very deeply. When it can be shown that free miles per gallon of fuel have been thrown away on all transport lines, on some military flying and on much private flying, as will be attempted in this and following articles, it becomes evident that the economy of air transportation has not had thorough analysis. Economy of operation for a given speed or given schedule-performance is subject to analysis and control in the air quite as scientifically as it is on the railroad or other means of transportation.

Comfort, the last of the four general problems, becomes, as competition increases, one of the most important concerns of all airlines. Comfort involves chiefly temperature, ventilation, noise reduction, vibration reduction, avoidance of rapid changes in density, and air roughness. Except for heat in summer, and for the roughness of air, all are controllable through design and regulation. These two are influenced principally in a favorable direction by the same type of solution, namely flight at higher altitude, which also favorably influences speed, safety and economy.

For all except the racer, the entire operation of which is technically an emergency condition, cruising is the most important flight operation. It predominates by a five to one margin over all other operations. Military flying as well as commercial and private flying are included in this sweeping generalization.

Main instrument panel and control pedestal of the Douglas transport with which the tests were made. A: Instrument light switch. B: E-9 engine fuel selector. C: Throttle lock. D: Propeller control. E: Primer.

During the War no pilot ever operated at full rated engine power except during a very small fraction of his flying time. Usually he nursed his engine. Usually the private owner nurses his engine. Universally the transport pilot cruises at some cruising power-output at present highly indeterminate, and depending too often on his temperament or that of the management rather than upon knowledge or scientific principle.

A diesel engine designer recently inquiring of a transport pilot what the power operating conditions were for an air transport line asked if in a new aircraft diesel he was planning, it would be best to design a 1 000-hp or a 750-hp unit. The pilot answered, "If you design a 1,000-hp. engine then we can operate it at the power we now need on the airline, namely 750-hp." The designer was amazed. It had never occurred to him that air transport operation was carried on at less than the rating of the equipment. To this designer, cruising means operation at rated power, not at less than rated power nor at emergency power, which he would consider respectively as normal light running and normal overload for his diesel.

The rating of an aircraft engine is not, like that of other power plants based upon the power that can be taken out indefinitely or on the power which is expected to be the normal output. A turbo electric plant rated at 10 000 kilowatts would operate years on end at 10 000 kilowatts without being considered unique or beyond its 'cruising' capacity. The 1 000-hp airplane engine, on the other hand, is rated not at its cruising output, as was evident at last to the diesel designer, but at its emergency output. It may have a special cruising rating at 75 per cent power—750 hp.—with rated revolutions at 91 per cent or the normal rated revolutions. It is possible that with a clearer recognition of the relative importance of cruising and of high speed or full power both airplane and engine manufacturers will gradually modify their rating systems, bringing them into more logical agreement with other prime movers and transportation modes by regarding cruising power and cruising speed and cruising climb as the rating points on the power and performance curves. This tendency would rate the engine's power at the only reasonable value namely the power that could be taken out normally in continuous operation as at present conducted. The airplane would be rated at the speed realizable during the level-flight part of a cross-country trip at a specified altitude. It is essential to keep this primary distinction clearly in mind when rated and cruising powers and engine revolutions are under discussion.

Cruising defined

If we now set ourselves the task of defining cruising, we find in a survey of flying operations that it includes all non-emergency flying. Take-off and climb, while usually performed at full throttle, often utilize but 60 per cent to 80 per cent of the rated power of the engine on account of the low engine revolutions and the low ramming of the air-intake. With a supercharged engine or a controllable-pitch propeller the case becomes somewhat special, but even in these cases the takeoff and climb are not ordinarily accomplished at full power. Full-power, high-speed level flight is purely an emergency operation, and does not appreciably affect the life or maintenance costs of the equipment because it is virtually never used.

Cruising conditions then are the operating controls which govern the non-emergency use of the aircraft to adjust it most adequately to the service it is called upon to deliver. These conditions vary with the type of aircraft, with its service requirements with the development of improved design and materials, and with increased knowledge about maintenance and statistics on costs and reliability. During the past decade avi-

ation has, however, come to an understanding of its economic future Statistics have been intensively gathered and intelligently studied Development in metallurgy, engine design and aerodynamics has been very pressing compared with similar periods in other industrial development. This has been a preparation period for the decade just ahead of us, which is destined by the new correlation of the aeronautical sciences to be one of immense enlargement Among the results of this preparation is to be found the fund of engine reliability data and forced landing analyses of the companies who have most thoroughly and minutely prepared for the new decade Airplane and engine manufacturers, usually collecting their data quite separately, and separately too from the transport lines, the military services, and the Department of Commerce (for private flying), have amassed and collated scientific information with regard to their product and their future products realizable soon with present technics Within these data we find our cruising criteria.

For cruising is simply the stressed condition under which we can operate indefinitely with the required reliability The experience of each user of aircraft has been slightly different, but a general similarity runs through it. It is at this cruising demarkation, very definite for the equipment manufacturer because he guarantees his product for this use, that the specifications are aimed in determining the duty at which operation is to be carried on. Abuse or emergency operation are usually not covered by these cruising guarantees. Thus cruising becomes the criterion for air transportation.

In military service

To the military services cruising has certain special meanings. The purposes of military flying are principally to attack, to observe, and to carry out a mission. For certain types of attack tactics, such as that of the interceptor fighter, and alert defense airplanes, full power climb and full-power attack may constitute a certain definite but extremely small portion of their operation. For all other military operations, except possibly when pursued and running away, and even for the attackers during the greater percentage of their flying life, cruising conditions govern their operation. These cruising conditions, different as they may be from those governing commercial transport flying, differ also between the Services, long range bombers requiring more careful limitations of stresses on the airplane, and usually more conservative power limitation than the fighters. The determination of the exact cruising limitations is a matter of compromise between the demands of the service for performance and for reliability How much influence the manufacturer's guarantees have on this determination is a matter of conjecture, since probably the Services have had a great deal of effect upon the manufacturer in demanding ever more cruising power

Since engine wear, liability to failure, and maintenance costs, even though the latter are to be disregarded as in some military missions, are principally determined by the hours of cruising operation, cruising is too often subordinated or entirely neglected as *the criterion* of military aircraft performance in the purchase of equipment. At the military testing agencies, cruising speeds quoted by airplane manufacturers, purveyors to the government, are greeted with great scorn. While accepting the high speed quotation as accurate, the service pilots say regarding cruising, "If you say it will cruise at 180, actually it will probably cruise at 140." Their incredulity originates with the word "cruising." It is quite true that most quoted cruising speeds have been cursorily tested by aircraft manufacturers, if in fact actually tested at all rather than computed from high speed. There is nevertheless a serious lack of specificity in the mind of the scornful service test pilot It is he who doesn't really know accurately what he is talking about when he says "cruising." When he says high speed he has a very definite point in mind: level flight at full throttle with engine turning its rated revolutions at critical altitude, and then this value corrected to standard conditions. When he says it will cruise about 140, he really means that as he flies on cross country flights with his individual habit of throttling to "save the engine" with nothing but a vague idea of power output, he will average 140. Does he know that altitude makes a difference in cruising speed?

One of the reasons for the lack of importance of cruising to the military services has been that their testing services have concerned themselves almost solely with high speed and full throttle climb. The division between testing personnel and field service personnel has often led the Services to despair of realizing their own testing pronouncements for actual service operations. Until recently any cruising speed testing has been frowned upon because of the unreliability and poverty of the technique of cruising power determination. Usually it is relatively easy to measure maximum speed and to determine whether the engine is delivering its rated power under these conditions It is not quite so simple a matter to fly at some predetermined "cruising power," such as 525 hp, especially when the engine is supercharged to some altitude high above sea level and is rated at that altitude In stopping short of a complete power determination there has been a tendency to state cruising speed without stating the cruising power. It often seems to be implied that cruising power is any power less than "full" power, hardly the sort of control which a locomotive engineer would exercise

The military Services have an official convention that cruising is operation at 75 per cent power How is it possible, however, for the cross-country pilot to know when he is using 75 per cent power? At what r p m for each altitude? At what manifold pressure? At what propeller pitch?

The Service personnel have the problem of deciding upon a cruising power output suitable for their operations, and then of finding means to determine this power in flight and to control it at the touch of the pilot for all conditions of altitude, temperature, flight attitude and propeller pitch. The single engine-revolution guide used in the past is hopelessly inadequate and erroneous It fails both in protecting the engine from overstrain and excessive wear, and in achieving a satisfactory performance.

In private flying

Private flying, as engaged in by owner pilots for pleasure or business, for instruction, excursions, or commutation, suffers from a similar predicament The owner buys an airplane which is supposed,—it may even be so guaranteed—to do 100 m p h. This does not mean that the owner will ever fly at 100 m p h, he will probably never wish to punish his engine to this extent He will "cruise" throttled to "approximately half throttle." With no means of power determination or control, he will use anywhere from 35 per cent to 90 per cent power without realizing in what range he is operating He will be disappointed to find that he cannot fly between two fields 80 miles apart in an hour unless he has a tail wind; with a 40 mile head wind he will barely make any headway at all

The cruising limitations upon private flying are usually lower than those upon military flying The private pilot is usually not concerned with peak performance so much as with reliability and low maintenance costs His guide is r p m regardless of altitude, temperature, propeller pitch, or intake ram Since rated engine revolutions have been rising with the passing years, it follows that habit holdovers will tend to cause the private pilot to fly at the cruising r p m of former years with a resulting low performance and low maintenance costs Individual private pilots with no large background of engine reliability experience to judge from, have no criterion for controlling their cruising except for an engine manufacturer's general recommendation and a somewhat variable Department of Commerce ruling, both tending toward a reduced cruising power.

The Department of Commerce has gradually enlarged its supervision over the details of performance and has recently taken the attitude that cruising performance on new airplanes shall be gone into rather thoroughly. The delimitations of cruising that have been officially recognized are the conventional ones and serve as a rough guide to critical altitude when the test is done under standard atmospheric conditions They are not required to be accurate, because performance is here usually not a matter of primary concern Unless the propeller pitch has been carefully set for full power determination at critical altitude, the cruising power determination may be almost anything Whatever cruising may be for military services, for private flying, or for transport lines, it is for purposes of government regulation, flying level at the altimeter reading corresponding to critical altitude for the engine involved, and at 91 per cent of the revolutions which the engine will turn at full-throttle at this altitude in level flight How erroneous or limited this conception may be we shall see later when we analyze power determination in flight.

In transport service

On airline operation, cruising becomes the single means of engine operation except for the rare emergencies when full power is necessary to prevent disaster Let us bear in mind that "full throttle" is not synonymous with "full power" Certainly "high" or maximum speed which is usually the one basis upon which most transport airplanes are sold, is *never* used to operate those transport airplanes This paradoxical situation illustrates the fascination-thralldom in which we have been held by the notion of top speed. Part of its justification is found in the lack of specificity of cruising speed test results The transport company has usually purchased the airplane not on the basis of its schedule-making possibilities between Oklahoma City and Dallas, for instance but on the attraction of its top speed, 90 per cent of which was glibly supposed to be its cruising speed Certain transport companies attempted to find a way out of this unsatisfactory situation by specifying a cruising speed at a certain r p m, but it was soon discovered that there were all kinds of loopholes in this, as we shall see presently There has been a great need for a systematic study of cruising, a means of eliminating the economically wasteful guessing of present methods, and a way of testing aircraft under operating conditions for guarantee purposes There has been little scientific approach, such as that governing steamship operation, to the control of cruising to meet the specific speed, safety, and economy problems of aircraft operation.

(To be continued)

The Airplane Inspector

PROBABLY in no other industry is inspection so thorough, so untiring as in aircraft manufacture From the time stock is received until it takes to the air it is being constantly subjected to the unceasing vigilance of those specialists whose job it is to guaranty quality regardless of the cost How a typical inspection system operates is well illustrated at the plant of the Boeing Airplane Company in Seattle, where approximately 35 inspectors are employed in addition to some thirteen regularly stationed at the plant by the Army and Navy Theirs is the responsibility of protecting the quality of the production When it is considered that some parts go through as many as twenty inspections before being released, the scope of their job is apparent. Parts range from sizeable wing spars and also units to tiny rivets and bolts They are inspected for dimensions, for errors in manufacture for the quality of material and for quality of workmanship.

Inspectors are stationed at various points throughout the shops and at two main booths All small parts from the machine shop, welding and brazing shop, forge shop and sheet metal shop go to the booths for inspection after primary operations Larger parts are examined on the floor by the inspectors as they go through the shops

The great majority of stock used by the Boeing company is received in the raw state for fabrication entirely within the factory On its arrival it is inspected for dimensions, possible flaws, chemical composition and t e n s i l e strength Until tested all material is held in the company's bonded warehouse. Provided both the inspection and engineering departments are agreed that it comes up to requirements it then is released for fabrication. Speaking generally, it is then inspected after forming, heat treating, anodizing or cadmium plating, application of primer, sub-assembly, application of finish and final assembly. Each component part of a fitting or other assembled item receives the same painstaking attention

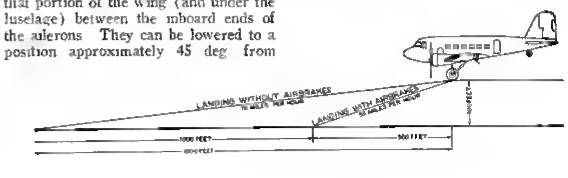
There are two heat treating rooms in the Boeing plant—one for duralumin and the other for steel The duralumin heat treating process is constantly checked to see that proper temperatures are maintained. Parts also are Rockwell tested after heat treating to definitely determine that they meet the proper strength requirements. In the case of steel heat treating, inspection includes not only the examination of finished parts, but also the regular checking of furnace temperatures Test pieces are included with each consignment of parts treated and these are referred to the test engineer.

Inspection methods differ, of course, for different materials and different parts, but inspection is uniformly thorough. Representative inspection is not relied upon, every part no matter how small, receives individual attention. An inspector is not permitted to examine certain selected parts from a pile, then pass the entire quantity. He must look over every item before giving his approval

Four tags are used to designate the parts which have passed through the inspector's hands—blue for "Accepted", red, "Rejected", white, "Hold" (for further inspection); and pale blue for "Final Acceptance" on sub-assemblies and final assemblies. When an entire airplane has been finally approved a stamp or name plate bearing the signature of both the company and government inspectors is attached.

Air Brakes for Airliners

WHAT can be done with flaps in the case of a large transport machine is well shown in the diagram below The Douglas transport of which some 40 are now on order for Transcontinental & Western Air is the largest machine in the United States to which the split trailing edge flap has been applied. The flaps extend across that portion of the wing (and under the fuselage) between the inboard ends of the ailerons They can be lowered to a position approximately 45 deg from their closed position Flight tests have shown that the landing speed of the ship is reduced from 70 to 55 m p h with the flaps down and that the distance required to ground the ship from an altitude of 1,000 ft. can be reduced by some 67 per cent. The advantages both for normal and for emergency landings are obvious



Efficient Maintenance Base at the Twin Cities Is an Important Factor in Northwest Airways' Out-tanding Operations Record

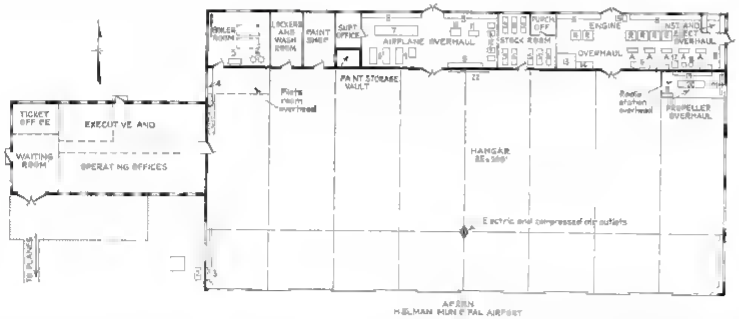
"In the Northwest..."

By S. Paul Johnston
Associate Editor AVIATION

Refilling valve guide bushings in a special lathe jig in the engine shops at Northwest Airways

"IN the Northwest it's the Northwest Airways'." So reads the slogan of the airline which for over seven years has linked together the cities in the Northwest territory with passenger and mail services. Originally organized by Col. L. H. Brittin—now executive vice-president—to operate between the Twin Cities and Chicago, its operations have been pushed westward with the succeeding years through the North Central States and to Winnipeg in Canada. Within the past year its planes have been flying regularly westward from Fargo to Billings, Mont., and announcement has lately been made that in the very near future passenger services will reach the West Coast to Seattle by way of Spokane. Step by step, like the pioneers who fought their way a century ago across the Dakotas and through the passes of the Rockies, its progress has been steadily westward. Seven years of operation through conditions ranging from summer dust storms of the plains through the ice and snow of the Northwest winters with an enviable record for regularity and without the loss of a single passenger speaks well for the operation in general and indicates a high degree of efficiency and care in the maintenance of equipment in particular.

Continuing our studies in the field of airline maintenance which has been reported in some detail in the pages of AVIATION during the last two years, it was our privilege, at the invitation of General Manager Croil Hunter, to spend a few days recently at operations and maintenance headquarters on the Holman Municipal Airport at St. Paul. Located approximately at the center of the present system, this plant now handles and will probably continue to handle the bulk of the maintenance and overhaul work on all the equipment with the exception of the normal field servicing usually done at outlying stations.



Layout of the St. Paul base of Northwest Airways, Inc. In this compact unit are housed all the necessary facilities for handling passengers, operations, radio, overhaul and maintenance. The principal equipment shown in the hangar is as follows: 1, Fuel pit; 2, Fuel pump; 3, Fuel pump control; 4, Storage battery charging unit; 5, Air compressor; 6, Hot water tanks; 7, Welding bench; 8, Sheet metal brakes; 9, Sheet metal forming rolls; 10, Band saw; 11, Sewing machine; 12, Grinders and drills; 13, Spray cleaning hood; 14, Cleaning tanks; 15, Valve grinder; 16, Lathe; 17, Drill; 18, Grinder; 19, Propeller rack; 20, Prolexaline table; 21, Balancing stand; 22, Engine and airplane time record board; B, Benches; L, Lockers; S, Stock racks; E, Engine parts racks; A, Engine assembly stands.

One phase of airline operations in the Northwest territory. Transferring air express matter directly from railroad cars to a Northwest Airways plane at St. Paul

A Northwest Airways Ford Transport receives its final touches before departing on its daily flight to Chicago

At the present time the flying equipment consists of three Lockheed Orions with the new 550-hp. S1D1 Wasps; three Wasp-powered Fords; eight Hornet powered Hamiltons; two Wasp powered Travel Air cabin monoplanes; one Wasp-powered Fokker Universal (for official use); three J-6 Whirlwind-powered taper-wing Wacos (one of which has been specially streamlined and speeded up for the personal use of Fred Whittemore, operations manager); one J-5 Whirlwind Stearman (for blind flying instruction), and two Wasp-powered Sikorsky S-38 amphibions (not in active service). The first of a number of Lockheed Electras (two Wasp Jr.'s) ordered by Northwest will be test-flown at the Burbank factory in the near future. The total engine inventory now includes 28 Wasps, fifteen Hornets, four J-6's and one J-5. For these airplanes some 46 Hamilton Standard two-bladed metal propellers are in circulation.

Servicing schedules

Servicing and maintenance are conducted on the basis of a complete daily or trip inspection (representing five or six flying hours), a 35-40 engine check (conducted at St. Paul) and a thorough airplane and engine check at 100-hour intervals. The so-called 'light' checks (usually of the daily or trip nature) are conducted at all stations but the thorough 100 hour checks are carried out at the St. Paul base. Engines are pulled for complete overhaul at 350-hour intervals and propellers come off every 100 hours. They are tracked, reset and balanced at 100-hour intervals, etched every 200 hours.

The keeping of records of the servicing and overhaul of planes, engines, propellers and other accessories has been the subject of careful study and continual improvement. Log books and card records show the complete operating history of every piece of equipment. The inspection forms, incorporating a listing of every item of plane and engines for checking and initialling by the examining mechanic are printed on heavy cardboard whose color indicates the equipment covered (pink—metal airplanes; salmon—fabric airplanes; blue—radio and instruments, etc.). A novel feature of these forms is the incorporation of clearance tickets as perforated attachments to the bottom of each card. These tickets (or tags) properly filled in and signed by the chief mechanic responsible for the work must be filed with the dispatcher before any ship is given clearance from the station. The four tags, one for ship, engines, radio and instruments, must be hanging on the proper hook on the main dispatch board before the pilot can sign the final clearance before departure.

The responsibility for the condition of all equipment falls on J. B. LaMont who functions as superintendent of maintenance under Mr. Whittemore. Mr. LaMont supervises not only the work of the St. Paul base but also the servicing procedure at outlying stations. "Jim" LaMont is an old hand at the maintenance business, a real old-timer.

He worked with Glenn Curtiss back in the "June Bug" days, flew a ship of his own in 1911 and was chief mechanic for Lincoln Beachy before his untimely death. LaMont was associated with the Curtiss Company at Hammondport during the War and pre-War days, and he accompanied Ruth Law on her famous aerial expedition into the Orient in 1919. Since that time he has been contiguously connected with the business of keeping planes and engines in the air.

Organization

All maintenance and servicing work at St. Paul is allocated under two main divisions, the ship department, supervised by L. Koerner, and the engine department, under the direction of H. Aune. These departments handle everything connected with the flying equipment except the radio installations. The responsibility for the operation and the upkeep of the latter equipment rests with H. M. Bennette, who supervises not only the airplane installations but all ground equipment in the company's communication system as well.

In many airline maintenance bases the day-to-day servicing function and the strictly overhaul functions both for airplanes and engines are kept separated and separate crews assigned permanently to the several operations. At St. Paul, however, under present operating conditions the number of ships entering and leaving the station per day is such that it is readily possible to schedule the work so that separate overhaul and servicing crews need not be maintained, the ship department looking after the daily servicing on airplanes as well as overhaul—the same system being followed in the engine department.

The plant

All the St. Paul operations are housed in a modern brick and steel unit on the Holman municipal airport. An accompanying diagram indicates the dimensions and general arrangement of the building. The wing on the west end houses the passenger handling facilities as well as the operations offices. Its close proximity to the hangar and general maintenance functions makes for an efficient and compact operating unit.

It has previously been pointed out in these pages that the quality of the housekeeping in an airline maintenance shop (or in any industrial layout, for that matter) is a good indication of the quality of the work turned out. On the basis of plant housekeeping the Northwest Airways shops rank high. Everything in the hangar proper and in the adjacent airplane and engine shops is arranged in an orderly fashion and apparently great effort is made to keep everything in its proper place and to keep the floors, walls and windows clean. Liberal use of white paint on the walls and roof structure, as well as plenty of glassed area makes for very excellent daylighting of all parts of the building. Lockers are provided for all tool and loose equipment. An outstanding example of the way things are done is the boiler room—frequently a neglected spot—but in the Northwest hangar a model of neatness and obvious efficiency. The same could be said of every shop and enclosure in the building from the mechanics' locker rooms through the airplane overhaul, the stockroom and the engine overhaul.

Since most of the equipment in use on the line is of all-metal construction, the airplane overhaul shop is well equipped with tools for handling steel and duralumin sheet parts. The shop is capable of making any sort of repair on metal airplanes and also manufactures ring cowlings, exhaust manifolds, etc. Complete welding equipment is also on hand for the repair of manifolds, engine mounts, and landing gears. The shop can also handle any required work on the few steel tube fuselage machines still in service. For the same purpose it is necessary to maintain a certain amount of woodworking equipment and also to provide sewing machines and cutting tables for making fabric coverings for wings and fuselage. It will be noted that the airplane overhaul shop is adjacent to the stockroom with direct communication through a suitable door. All materials for airplane structures is kept in stock bins immediately adjacent.

The paint shop adjacent to the airplane overhaul is fitted up to handle all sorts of finishing jobs, internal or external, including the doping of fabric surfaces. DeVilbiss spray equipment is installed drawing air from the central tanks and compressor in the boiler room. Painting supplies are stored in a fire-proof vault which opens directly into the shop. A large ventilating fan sucks air from the room and discharges it through a stack. Fresh air is admitted through ducts from out of doors.

Engine overhaul

Under present conditions the engine shop handles twelve to fifteen engines per month. With production on this scale it has been found more economical to operate on an overhaul crew basis rather than on the production line method commonly used in shops handling 40 to 60 engines per month. Incoming engines pass first through a teardown, cleaning and inspection department and are then turned over to an engine mechanic and a helper who, as a crew, do the entire job of putting the engine back into shape, with the exception of certain highly specialized jobs mentioned below. Complete inspection records and assembly records are carried on suitable forms. Carburetors, electrical equipment, instruments and ignition equipment are taken care of by mechanics who are specialists in those particular fields. A machine shop in charge of an expert machinist is an integral part of the engine shop and takes care of all machining requirements including all connecting rod and crankshaft work. A number of clever and interesting tool set-ups have been developed for connecting rod boring, valve guide bushing, and other operations. One such is shown in an accompanying illustration. Detailed descriptions of certain outstanding jigs, fixtures and gadgets from the engine and other departments will be treated in the "Servicing Short Cuts" pages of AVIATION.

At present there is no fixed engine run-in equipment at St. Paul. After overhaul, however, all engines are run in on a heavy dummy fuselage (built of sheet iron and steel tubing) which is pushed out on to the apron in front of the hangar and anchored in place. The cockpit is fitted up with a complete set of engine indicating instruments and controls. It is difficult to run gasoline and oil consumption tests with this equipment, but complete measuring apparatus for this purpose will be installed in the new test stands which will be included as a part of a shop extension soon to be erected.

Propellers

Propeller work is handled in a small enclosure in the northeast corner of the hangar proper. This shop is equipped to take care of polishing, balancing, tracking and setting, but at the present time no etching equipment is available at St. Paul. This work is now being done in an auxiliary propeller shop in the Northwest Airways hangar at Milwaukee, but with the completion of the contemplated extension of the St. Paul shops it is planned to move all etching equipment to the main base.

The shop is full of interesting items which, as indicated above, will be treated in detail in later issues of this magazine. Among these, the storage battery charging equipment is noteworthy. There are also interesting methods worked out for handling engines in and about the shop as well as special devices for leveling up planes for compass swinging, the protection of propellers while in the shop, special devices for building cowlings, and many others of which limited space prevents adequate discussion in the present article.

The acquisition of the new Lockheed Orions (three of which have already been delivered) and later the twin-engined Lockheed Electras which have been ordered for high speed service between the Twin Cities and Chicago, will introduce a number of new problems for this shop, but with the present nucleus of trained personnel and adequate shop facilities there is little question but that they will be met efficiently and promptly.

The industry and the A. F. of L. discuss the proposed aircraft manufacturing code

In Open Forum

PUBLIC hearings on the NRA code for the aircraft manufacturing industry, conducted in Washington, Dec. 20, resolved themselves into the presentation of three major briefs, two in support of the code submitted by the Aeronautical Chamber of Commerce of America and one, on behalf of the American Federation of Labor, requesting a series of amendments to this code to provide for shorter hours and greater pay.

After a hearing which lasted only two hours, Deputy Administrator Karl J. Ammerman called a recess, "subject to call of the administrator, if he so desires."

The arguments in behalf of the code as submitted were made by Leighton W. Rogers, executive vice-president of the Aeronautical Chamber, who supplemented his oral presentation with a number of written appendices, and by Col. E. V. Rickenbacker, ranking American ace during the World War and now vice-president of North American Aviation, Inc.

The brief of the A. F. of L. was presented by Merle Benton, of Buffalo, N. Y., and was endorsed by several representatives of the aeronautical workers, without supplemental remarks.

Representatives of many of the leading aircraft manufacturing plants were present at the hearing but took no part in the discussion. Aside from the arguments for the code presented by Mr. Rickenbacker and Mr. Rogers and the arguments for its modification presented by Mr. Benton, there was no discussion of the code when it was called up section by section for detailed argument.

The proposed code provides for an average 40-hour work week and minimum wages of 40 cents an hour for ordinary labor, 32 cents for apprentices, $15 a week for office employees and $12 a week for office workers who are minors. It covers airplane, airship and aircraft engine manufacturing and also the manufacture of propellers, instruments, spare parts and accessories.

Mr. Rogers, in his remarks and appendices, detailed the complete history and present status of the industry. He pointed out that the code, if adopted, will provide a 10 per cent increase in employment, but that the 12,328 wage-earners at present represent nearly all that can be employed because of the present state of the business, the slow development of private flying, failure of Congress to provide adequate funds for the procurement programs of the Army and Navy, and drastic reduction of Post Office Department funds for air mail, which cuts down the business to be expected from the air transport lines.

Col. E. V. Rickenbacker.

In concluding Mr. Rogers said: "With all other industries that of aircraft manufacturing is passing through the most crucial period in its history. Immediate steps required to bring it through are reasonably elastic working hours, maintenance of the present high standard of wages, the perfection of industry self-government, the elimination of destructive unfair trade practices, and a fulfillment by the government of its part of a former obligation to provide funds for development of the airmail service and the maintenance of an adequate air force."

Colonel Rickenbacker argued that the industry deserves and needs co-operation of the NRA because it is an essential unit of the defense establishment, an industry which on short notice may be called upon to deliver to our military and naval forces the greatest possible number of aircraft capable of striking down an enemy before that enemy can strike at us."

He said that before business men would again put up capital necessary for a thriving manufacturing industry, they must first be assured that the aircraft plants will be permitted to manufacture according to work hours and methods which experience had proved practical, that they must be assured that the government will not abolish its air forces, and that business be assured that the government will continue to foster development of the air transport industry through the medium of airmail expenditures necessary to expand passenger and express traffic to a point which would render the lines self-sustaining.

Mr. Benton, in presenting the labor argument, contended that the 40-hour week proposal would not increase employment in the industry and suggested a 30-hour week, with daily, as well as weekly limitations. He argued for a minimum wage for the lowest paid employees, of $19.50 a week of 30 hours, or 65 cents per hour.

He stipulated that there shall be no split shift work in the industry; that hours worked in any one day shall be worked consecutively from starting time to quitting time.

He proposed a new paragraph to provide that nothing in the Code "shall supersede provisions with respect to hours, wages and conditions of employment which are established for specific projects by competent governmental authority acting in accordance with law; or with respect to terms of employment which are established by labor agreements now in force where either the wages are higher or the hours of labor are shorter, or both, than are those set forth in this Code."

Mr. Benton also submitted as an amendment to Article V, on administration, a new paragraph providing for constitution by the Administrator of a joint industrial relations board of the industry consisting of equal numbers of representatives of employers and employees and an impartial chairman elected by the members of the board, to serve as an adjustment agency with respect to hours, wages and general labor conditions.

It will be recalled (see AVIATION, September, 1933, page 290) that the code as first drafted contained a provision aimed to prevent manufacturers from making use of designs other than their own without adequate compensation to the originator. The conflict that was anticipated between the industry and the officials charged with the procurement of equipment for the Army and Navy over this point was avoided by the insertion of a clause in the revised code specifically exempting the Services from any limitations under this provision. The assumption is, in this case, that the government, in looking to the defenses of the country, "can do no wrong."

As has been the case in all code hearings, no opportunity was given either side for rebuttal. The final disposition of the revised code now rests in the hands of the Administrator.

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

Notes on a $700 Airplane

This editorial has no relationship to the feature article elsewhere in this issue on the low-priced airplane. Each was prepared separately. One expresses the official, the other the editorial, view of the project. On some points the two are in agreement. On others they are not.

WHEN Director of Aeronautics Vidal launched his famous private plane questionnaire, a considerable segment of the aircraft industry thought it a joke—and not a particularly funny one. When he persuaded the Public Works Administration to make over $500,000 to promote the realization of the project as a means of developing a new industry to provide new employment, the joke ended. Half a million dollars are to be regarded seriously, even in days when federal expenditures run to six billion and higher.

So now we must see what this proposal really is, and what possibilities it holds. The idea of the airplane market that is being formulated in the Department of Commerce and the idea to which most present-day manufacturers subscribe are as far apart as the Pole and the Equator. Who knows the truth?

What is the private airplane market for 1934? Is it a market for 600 or 800 planes, or at best for two or three times that number, or can it be stretched to tens of thousands? Is it centered upon those already "interested in aviation," and especially upon those who have already had flying instruction, or does it lie mainly beyond the boundaries of that group, among the great and now indifferent public? If the latter, are its demands satisfied by the types of aircraft now on sale? If not, can they be met within the existing resources of aeronautical engineering, or must they wait upon further discovery and invention? Assuming for the moment that there is a potential urge to buy private aircraft on a grand scale, what prevents its conversion into actual purchases? Is it first cost alone that we must blame? Or is there something else?

First as to cost. Certainly that is important. Roughly speaking, all industrial experience indicates that the available market for any fairly expensive article varies as the inverse square of the cost of purchase and up keep. A certain number of automobiles can be sold each year at a minimum price of $500. If the minimum were $1,000, the sales would be reduced nearly if not quite three-quarters. Raise the price to $2 000 and another 75 per cent drop will be required.

So too with the airplane. The present minimum price for light two-place ships is about $1,400. Cut that price to $700, and cut the upkeep costs in the same ratio, and automatically there will arise a new demand for about 1,000 additional planes a year under depression conditions, or about 5,000 a year under conditions of general prosperity. Given a little improvement in business outlook, something like the 1929 figure of number of units produced could readily be regained, but we should still be far short of realizing the hopes of the Aeronautics Branch. To make good on 10,000 airplanes a year, still more will be needed. We shall have either to make marked improvements in the airplane, or marked changes in the conditions under which it now has to be used, or both.

IT IS EASY to talk glibly about building an airplane far better than any now existing. It is not so easy to do it. A good many reasonably competent men have been devoting their whole time, for many years past, to the effort to produce the best planes possible. As a matter of fact there is not the slightest reason, notwithstanding all the romantic talking that has been done in the daily press and elsewhere about the new miracles that are to be materialized and that are to make flying easier than slapping the reins over the back of a mule, to expect any marked innovations in design. There is no reason to suppose that it is possible to go straight forth and build an airplane better in any general way than the best that are now available. But it is possible, within the limits of existing knowledge, to build a *different* airplane and one which for certain purposes might be superior.

Forget for a moment the man already skilled in the art. Think for a moment with the complete novice, with no aeronautical connections. From his point of view, flying cannot be too easy. Maneuverability and lightness of control are comparatively negligible. Extreme stability is his first requirement. Low landing-speed is second. A landing-gear tough enough to stand being socked into the ground in a straight glide is third. In short, this imaginary customer wants very much the characteristics for which the Tanager and the Doodlebug were designed in 1929, and he wants them at less than one-eighth the price at which either of those ships could by any possibility have been built.

And he wants more than that. He wants a machine that looks right to an eye that has been trained largely on automobiles. Cantilever wings and an absence of external bracing members will appeal to him. Solidity of appearance will appeal, for without having the slightest knowledge of structures he has an uneasy feeling that present-day light planes look flimsy.

A PLANE OF THIS SORT could be built, in quantities approximating 10,000 a year, for a factory cost of not very much over $600, a large proportion of the reduction of the price from present levels being due to the effect of standardized quantity production on the cost of accessories and parts. It would not replace, and indeed would not really compete with, existing types. It would have no maximum speed to speak of, and its characteristics would be thoroughly unsatisfactory from the standpoint of four-fifths of the present-day pilots, though they might accept it if they could get nothing else at the price. No such machine now exists, and it would take a number of months to create one and bring it to the point of production. Is it worth while?

That brings us again, and for the last time, to face the question of the market. The editor of AVIATION expressed the view last month that it should be possible to dispose of about 7,000 planes of this type during the first year, but that a partial saturation would then have been attained and that the next year's sales would be less satisfactory. That is still our guess. We have heard other guesses ranging from an annual production of 200 to one of 100,000. In any case, we believe that the chances of finding a new market and drawing a lot of new customers of a new type into aviation are good enough so that the experiment should be tried, if it can be done on proper terms.

"Proper terms" demand careful study. If anyone supposes that the project can simply be dropped into the lap of the industry at this point, even though it be accompanied by $500,000, a great awakening awaits him. If that were to be the plan, it would be far more profitable, and get more good airplanes into the hands of the public, simply to apply the $500,000 to reducing the cost to the purchaser of existing models.

If this scheme is to be tried and to be a success, the government must carry a share of the load throughout. There is nothing fundamentally new in the notion of mass-producing airplanes and selling them in quantity at a low price. Many manufacturers have played with that idea. None of them ever made a success of it. To develop a machine suitable for such a market, and to make the necessary preparations for production, distribution, and servicing, would cost not less than $1,800,000. If any commercial group were considering whether to risk over a million dollars of their own money, the mere fact that half a million was to be made available by the government would not be a decisive factor. The government must contribute more than money. It must contribute prestige and promotion, from start to finish.

MAYBE this is all a dream, but we have tried to give the dream some substance by at least discriminating between what might be done and what seems totally inconceivable. If the thing is worth trying—and the Aeronautics Branch is on record as being quite certain that it is—the first step is to get out an airplane, in sufficient numbers so that a really thorough service test can be made before starting production. That is work to be intrusted to those existing organizations that offer the best propositions. If the $500,000 of Public Works money now available can be used to develop new types of airplane and engine, designed for quantity production and to appeal to the broadest possible market, and to put at least 40 of the planes in the air and fly them all over the country, it will have been well spent. Then, too, we shall be able to get some idea of how many firm orders are actually in prospect, and of how much financial risk production is to entail. Until then, it will be quite appropriate to discuss in general terms the organization that might be set up for production and the ways in which it should be controlled, but it will be worse than a waste of time to seek to complete all the details or to secure definite commitments.

In the Course of Duty

THE TRADITIONS of the U. S. Navy were once more upheld when Lieut. Commander Knefler McGinnis and his officers and men demonstrated to a group of enthusiastic Hawaiians that their island outpost was an overnight flight from the coast of California. Together with those responsible for the manufacture of their airplanes and equipment they have made an outstanding contribution to the aerial conquest of the Pacific and to the bond of friendship that exists between the people of our country and those of the Hawaiian Territory. To Commander McGinnis and his gallant associates who, in the "routine performance of their duty," have made aeronautical history, we extend our heartiest salutations.

Those of us who are familiar with recent activities of the Navy know that the performance of the six flying boats follows, in logical sequence, other long-distance formation flights of the same squadron. The distance from San Francisco to Pearl Harbor is only a little over 300 miles longer than the Hampton Roads-Coco Solo Jump of last fall. At that time it was suggested in these columns that the same boats be flown from California to Hawaii. We have had our answer.

Although the Navy now holds the world's record for non-stop formation flights, there are other fields left to conquer. Commander McGinnis has said that, had it been necessary, it would have been possible to continue without stopping, to Midway Island, more than 1,000 miles distant from Pearl Harbor. Beyond Hawaii, in the South Pacific, the island stepping stones are relatively numerous, and opportunities for mass formation flights, of definite political value, are plentiful. We hope and we feel sure that we will hear from Squadron 10-F again.

NEWS OF THE MONTH

Perfect score for Navy

A NEW world record for non-stop mass formation flight was set on Jan 10-11 by the "routine transfer" of the Navy's Patrol Squadron 10-F which covered the 2,400 miles from San Diego to its permanent operating base at Pearl Harbor, Honolulu in 24 hours 56 minutes. The six Consolidated flying boats, each equipped with two Wright Cyclones, carried their normal crew of 30, under Lt.-Comdr. Kneffler McGinnis. After considerable difficulty in taking off because of heavy load and windless weather, the squadron flew to its home base without incident, except for some blind flying through fog. Serving as radio guide posts, seven naval vessels, stationed at 300-mile intervals along the path, flashed to shore reports of progress. Maintaining an average speed of nearly 100 m.p.h. the patrol planes improved upon their own time for the record making hop from Hampton Roads, Va. to Coco Solo (AVIATION, October, 1933, page 361) which is the next longest mass flight in aviation's history, and for the one-stop flight from Coco Solo to San Diego (AVIATION, November, page 356). Again they bettered the record of Balbo's armada in its North Atlantic flight last summer. First successful flight to Hawaii was that of Maitland and Hegenberger, army aviators, in 1927, followed in the same year by Smith and Bronte and by the Dole flight winners, Goebel and Davis. In 1928 Charles Kingsford Smith and his crew of three negotiated the jump in their cross-Pacific flight to Australia.

Industry supports government

Organization of committees to serve in connection with the development of a volume-produced, inexpensive plane for private flying got quickly under way after PWA's announcement of a $500,000 grant to the Aeronautics Branch, Department of Commerce for the purpose of aiding such study (AVIATION, January, page 23). To decide upon the best method for obtaining mass production which will at the same time benefit the present private plane manufacturers, a committee, headed by Director Vidal, was appointed. The other members of the committee are Col. J. Carroll Cone, representing the National Aeronautic Association, Amelia Earhart, Dr. George W. Lewis, National Advisory Committee for Aeronautics, Robert B. Renfro, editor of *The Sportsman Pilot*, Leighton Rogers, Aeronautical Chamber of Commerce, Fred L. Smith, National Association of State Aviation Officials, Edward P. Warner, editor of AVIATION, and Capt. Al Williams, of the American Petroleum Institute.

Immediate outgrowth of the committee's first meeting in Washington on Jan. 4 was the appointment of three subcommittees. The first, which will confer with the aircraft industry on details of procedure in developing the low-priced plane consists of E. L. Vidal, chairman, Leighton W. Rogers, Edward P. Warner. To study details relating to the plane and the engine, Colonel J. Carroll Cone, chairman, Maj. C. W. Howard, Army Air Corps, Dr. George W. Lewis were appointed. Capt. Al Williams, Robert R. Renfro, Fred L. Smith will study the promotional phase. Ex-officio chairman of the full committee is Ewing Y. Mitchell, assistant secretary of commerce. To advise with the full committee a technical board was appointed, which comprised Luther Harris, Special Assistant to the Director of Aeronautics, John H. Geisse, Chief of the Manufacturing Inspection Service, and Richard C. Gazley, Chief of the Engineering Section, Aeronautics Branch.

Voting support to the government's private plane development project, 22 of the leading airplane manufacturers in the United States met at the Aeronautical Chamber of Commerce in New York City. To assist the government in working out technical details and complete performance specifications of the proposed plane, a committee was appointed consisting of R. S. Damon, president of the Curtiss-Wright Airplane Company, C. J. Brukner, president of the Waco Aircraft Company, B. D. DeWeese, general manager of the Stinson Aircraft Corporation, R. H. Fleet, president of the Consolidated Aircraft Corporation, and C. G. Taylor, president of the Taylor Aircraft Company. A second committee appointed at the same time will co-operate with the government in determining the legal and the economic practicability of organizing a corporation within the industry to undertake development and production of the plane. Members of this committee include S. M. Fairchild, president of the Fairchild Aviation Corporation, E. R. Breech, president of North American Aviation, Inc., P. G. Johnson, president of the United Aircraft and Transport Corporation, T. A. Morgan, president of the Curtiss-Wright Corporation, and Taylor Stanley, president of the Aeronautical Corporation of America.

Several leading aircraft and automobile manufacturers are said to be studying the possibilities of development of a volume produced plane. Pending further development of specifications, all hands refrain from definite commitments.

Transport—mail—defense

Synchronizing with federal plans for the private plane industry comes the announcement that federal air transport policies are to be co-ordinated so as to afford the greatest possible benefit to all users of transport systems, by organization of an interdepartmental committee, formed under the sponsorship of the Secretary of War, the Postmaster General and the Secretary of Commerce. Serving on the committee are E. L. Vidal, chairman, W. W. Howes, second assistant postmaster general, and Major General Benjamin D. Foulois, chief of the Army Air Corps. All air transport matters affecting two or more of these departments, including such projects as new lighted and radio equipped airways and passenger lines, will be considered by the committee.

Maintenance men meet

The semi-annual meeting of the Committee on Maintenance of the Air Transport Section of the Aeronautical Chamber of Commerce was held on Jan. 8 at the Hotel Biltmore in Atlanta. W. A. Hamilton, maintenance superintendent for Transcontinental and Western Air, and chairman of the committee, steered the discussion through an agendum which touched upon the practical problems of the installation and maintenance of such items as cabin heating systems, cowling, propellers, soundproofing, tires, ignition and instruments. The benefits that can be derived from the pooling of the experiences of the several airlines on such subjects is obvious.

Pan-American Airways' maintenance base at Brownsville, Tex. (see "Thunder Bird's Nest," AVIATION, February, 1933) was selected as the meeting-place for the 1934 summer session. Mr. Hamilton was re-elected to conduct the affairs of the committee for another year. Those present at the Atlanta conference included W. B. Click of American Airways, Fort Worth; J. L. Ruden and H. D. Ingalls, American Airways, Chicago; H. O. West, United Airlines, Cheyenne, Wyo.; J. C. Leslie, Pan-American Airways, Miami; G. R. Cushing and E. G. Cross, Eastern Air Transport; W. S. Rosenberger, Pennsylvania Airlines; and Fowler W. Barker of the Aeronautical Chamber.

Calendar

February 8-10—National Airports Conference, New Orleans, La. under the auspices of the Aeronautical Chamber of Commerce.
Feb. 9-12—Pan-American Races—Dedication Shushan Airport, New Orleans, La.
February—Dedication of Pan-American Airways System's International Marine Airport, Dinner Key, Fla.
April 27-May 8—International Show of Sport & Touring Aviation, Geneva, Switzerland.
May 27—Deutsch de la Meurthe Cup Race.
October—MacRobertson International Air Race, London to Australia.
November—Viceroy's Challenge Trophy 700 mile race, India.

51,000 men, 476 airports

CWA airport and landing field projects, promoted by the Aeronautics Branch as part of its private flying development program (AVIATION, January, page 25) are providing employment for more than 51,000 men, the Department of Commerce reports. Of the 467 projects in 41 states, 226 are new landing fields while 250 are improvements at existing airports. Minnesota leads with 63 projects, 6,248 employed men; Florida comes second with 43 projects, employing 4,600 men. Information on seven states could not be included in the report, presumably because applications for assistance have not been submitted or approved. Working under the experts appointed by the Department of Commerce, who advise as to the suitability of each site, are more than 100 experienced airport engineers.

A committee has been set up in the Aeronautical Chamber of Commerce to work with the Civil Works Administration toward the installation of five seaplane terminals, which will go to cities at no cost, providing they maintain them for five years.

Rivals

Internationally speaking, the center of attention in the air transport field is the South Atlantic where France and Germany continue their experimental flights in the race for South American markets. The Southern Cross, a long-range postal flying boat constructed by Latecoere with four 650-hp. Hispano-Suiza engines, recently set a non-stop seaplane flight record of 2,660 miles from Berre, France near Marseilles, to St. Louis, Senegal, West Africa; later, the ship flew on across the South Atlantic to Natal, Brazil, thence down the coast to Rio de Janeiro. On the basis of this performance, Air France, into which is being merged Aeropostale, the present French South American line, hopes to establish a service from Paris to South America, with the co-operation of the French government which has underwritten two more ships like the Southern Cross. On Feb. 1, according to present plans, Deutsche Lufthansa will start a regular five-day postal service from Berlin to Rio de Janeiro, using a combination of land and seaplanes with the Westfalen serving as floating airport. (AVIATION, December, page 383)

HAWAII WELCOMES NAVY

One of the Navy patrol boats as it appeared in Pearl Harbor, Honolulu, after the squadron had successfully completed its mass formation over-night hop from San Diego. The 2,400 mile record flight was characterized by Navy officials as "routine delivery of service planes under service conditions."

England's Imperial Airways approach their goal of London-Australia mail service with but 2,300 miles to span from Singapore to Port Darwin, since the new 1,500 mile extension from Rangoon to the Straits Settlements. A record flight with holiday mail was made by K.L.M.'s Fokker Pelikaan whose three Pratt & Whitney Wasps carried it successfully to Batavia from Amsterdam and back in less than five days for each leg of the journey. In China, Pacific-American Airways, wholly owned Pan American subsidiary, opened a 1,000-mile coastal service from Shanghai to Canton, via Hongkong. Survey flights are being made by Pan American in view of establishing an extension to Manila. At present mail is sent by steamer from Manila to the mainland, where it is picked up by France's Air-Orient and flown to Europe.

$1,000,000 for land transports

Latest contracts, amounting to $1,000,000 awarded by Pan American Airways in their $3,349,000 new equipment program were for twelve new transport planes of advanced design, capable of 200 m.p.h. Of these, six will be the new Douglas DC-1 (AVIATION, October, 1933, page 331); the other six are Lockheed Electras (AVIATION, June, page 195). Pan American's new fleet will be used to replace older, slower planes now in service on their routes through Mexico, Central, and South America. To use as a testing, repair, and "round-house" base for the six big flying boats designed for trans-oceanic operation, now under construction at the Sikorsky Aviation Corporation plant at Bridgeport and the Glenn L. Martin plant at Baltimore, Pan American, through the Marine Airport Corporation, bought a 10 acre plot adjacent to Port Washington on Manhasset Bay. The property includes one completed steel hangar, 130 by 140 ft., largest building of its type on the Atlantic coast, as well as a partly built hangar, factory, machine shop and ramp. The American Aeronautical Corporation, which owned the American rights to manufacture Savoia Marchetti seaplanes, started the development years ago; later it was taken over by the Lienholders Corporation.

By specifying 700-hp. Wright Cyclone engines and Sperry Automatic Pilots for the new fleet of 41 Douglas transports which will go into service in the spring, Transcontinental and Western Air completed its new equipment program, calling for $3,500,000.

Miami records

Sportsmen pilots, aviation notables, and other flying enthusiasts gathered at Miami, Florida during the second week in January for the sixth annual All-American Air Races held under the auspices of the N.A.A. Prologue to the races was the Amateur Pilots Invitation Cruise, culminating in the Henry L. Doherty Trophy Race sponsored by the Florida All-Year Round Clubs, of which Col. Clarence M. Young, former assistant secretary of Commerce for Aeronautics, is chairman of the aviation committee, and Col. Henry L. Doherty, president. Fifty-nine of the cruising pilots competed in the handicap race from Orlando to Miami, which was based on a novel system of handicapping where accuracy of timing and navigation were the determining factors. Winner of the trophy and $500 was Lawrence R. Sharples of Philadelphia's Pylon Club. Sixteen other prize winners in the cruise received prizes totaling $2,100.

Back from France to the United States came the world speed record for two-seaters weighing under 1,240 lb over a 100-km course (62 137 miles) when Jack Wright of Utica, N. Y., flew his special racing Monocoupe with Warner Scarab engine at an average speed of 167 842 m.p.h. Previous record holders were Freton and De Lavergne, making 138 905 m.p.h. in a Renault-powered Farman. Another first place was won by Jack Wright in the 15-mile triangular-course race for planes with engines of less than 450 cu in displacement. His speed was 162.124 m.p.h. Art Chester of Joliet, Illinois, in his Chester special took the Green Trophy race, averaging 209.03 m.p.h. Running away with the 30-mile free-for-all, Jimmy Wedell in his famous Wedell Williams monoplane averaged 232 148 m.p.h., more than 21 m.p.h. faster than Chester who placed second. Howard Hughes of California did 185.707 m.p.h. in the sportsman pilot free-for-all. In a four-cylinder monoplane built by himself, Lee Miles, Los Angeles speed flier, failed in two attempts to crack the world's mark for single seater planes in the second category over a 100 km course. Later, on Jan. 17, Miles succeeded by a small margin of 1.80 m.p.h. in breaking the former record of 207 392 m.p.h. established by the Frenchman Delmotte last May 22.

Regulations for racers

Special rules for air races and meets, designed to increase the safety of spectators and to make certain that areas contiguous to airports will be clear and unobstructed for participating pilots, were adopted by the Department of Commerce. Any airport at which a series of air races or other aerial demonstration is to take place must be divided into two parts, one for spectators and the other for participating aircraft. Airmen approaching airports at which air races or demonstrations are in progress will be notified of that fact by prominent ground markers. Limitations are set upon maneuvers by racing aircraft, as for example, aircraft must not fly toward, over or within 200 ft. horizontally of grandstands or other space reserved for spectators. Other rules define the responsibility of the air meet management with respect to compliance with Air Commerce Regulations and for policing of the airport. These rules were not written into the Air Commerce Regulations, but special authorization by the Department of Commerce is necessary for an air meet and this will be granted only when the officials agree to abide by the rules.

Free-for-all races in 1934 and 1935 will be limited to five displacement groups, 200, 375, 550, 1,000 cu in. and unlimited, according to the announcement of William P. McCracken, Jr., chairman of the Contest Committee of the National Aeronautic Association. Particular stress is thereby placed on the construction of specially designed racing ships in the smaller sizes, and it is expected that new features introduced in these speed planes will prove of value in the private owner field. In the future engine groupings must be announced at least a year prior to becoming effective, and broadcast to the industry.

Mail contracts under scrutiny

The air mail inquiry by the special Senate committee, headed by Senator Hugo L. Black, which is investigating foreign and domestic ocean and air mail contracts, opened on Jan. 9. First week of the hearing was divided into a general inquiry into the Post Office Department's practices in letting contracts between 1929 and 1931, and a study of some phases of the financial history of the aviation boom of 1927-29. Representatives of a number of independent operators of that period appeared at the hearing to protest that Postmaster General Brown had "frozen them out" in the process of building a nationwide air transport network around a few major systems. First of the major corporate units to become subject of inquiry was United Aircraft and Transport Corporation. Several of the officials of that company testified to large profits made in the course of the very rapid expansion that succeeded the formation of Pratt & Whitney Aircraft Company on a small scale in 1926.

Following the spectacular headlines over the air mail inquiry, Congress appropriated $25 000 for continuation of the investigation. The Department of Justice will make an investigation of its own into the provisions of present steamship and air mail contracts, which may be the basis of revision of some existing contracts with the possibility of the exercise of the Presidential privilege of cancellation, granted to President Roosevelt in the Independent Offices Appropriation Bill for the current year. Col. Carl L. Ristine, of Missouri who has not previously had connections with the aviation industry during his years at the bar, was appointed special assistant to Attorney General Cummings to review the testimony.

No quarter in wage war

When it became clear at the close of the National Labor Board's Dec. 14 hearing on the pilot-wage controversy, (AVIATION, November, 1933, page 354; December, page 382, January, page 26) that airline operators and the Air Line Pilots Association were no nearer reconciliation than before, both sides retired to appoint separate committees of five to try to find a common ground for discussion. Senator Wagner suggested that course after hearing from operators and pilots their opinions on the fact-finding committee report and failing to discover evidence that the report had accomplished anything whatsoever toward settling the complicated problem.

In the meantime, a new element of controversy appeared with the detachment from United Air Lines staff of David L. Behncke, Nicolas Laurenzana, and Oscar Hauetor Behncke, organizer and president of the Air Line Pilots Association, affiliated with the A. F. of L. has been foremost pleader of the pilots' cause during the past few months. Behncke, Laurenzana, chairman of the Pilots Executive Board in Cleveland and Hauetor, a union leader in one of United's western runs, have all complained that they were dismissed because of union activity. The hearing regarding them on Jan. 18 revealed conflict of testimony, which the Board took under advisement without immediate decision. Pilot Behncke claimed that though he had received permission in August for leave of absence to attend code hearings at Washington, he found that his place had been filled when he reported for work at Chicago in December. United Air Lines denied that Association activity was responsible for Behncke's release, since the reduction in pilot personnel due to winter schedule restrictions during his absence was made on the basis of merit alone, as evidenced by the fact that the company now has both association and non-association members employed. Laurenzana and Hauetor were released, United stated, as a result of the introduction of a competitive rating system for determining the comparative merits of pilots. Six days after the hearing, the Board ordered the reinstatement of Behncke with payment of base pay from the date of discharge to the date of reinstatement. The cases of Hauetor and Laurenzana were referred to the Chicago and Cleveland Regional Boards, respectively, for further study.

In the meantime, an election among T.W.A. pilots to determine who should represent them for collective bargaining is being conducted by the Labor Board. In December the Air Pilots' Association requested that such an election take place. On Jan. 10 a delegation of pilots from T.W.A. requested the Board to declare that no controversy existed. Charging coercion behind the request, the Pilots' Association complained that T.W.A. officials were asking their pilots to sign the petition to the Board. T.W.A. in turn complained to the Board that one of their co-pilots had been assaulted at Newark following his refusal to support the association.

On the complaint of the Aeronautical Workers local Baltimore union, the cases of Berliner-Joyce and General Aviation Corporation, wholly owned subsidiaries of North American Aviation Inc., was taken under advisement by the Labor Board on Jan. 22. It is alleged that the company refused to deal with union representatives. Acting Chairman Wolman said there were two issues involved, whether there should be another election to pick collective bargainers, and, if there is who shall be eligible to vote.

Faced by this elaborate tangle of issues, fogged in by the technicalities of a profession with which none of the Board's members have had previous experience, it seemed likely that a special aviation section of the Labor Board would have to be created or all other activities abandoned to concentrate on air transport.

F.A.I. to meet at Washington

The Federation Aeronautique Internationale, world governing body for aeronautic sport, at its 33d annual conference at Cairo, Egypt, Dec. 19-23 accepted the invitation of the National Aeronautic Association, its United States representative, to hold the next meeting in Washington D. C. next fall.

Air lawyers

To serve on the international committee engaged in developing a world code of private air law through international conventions the State Department recently appointed four aerial legal experts. John C. Cooper, Jr., of Jacksonville, chairman of the committee on aeronautical law of the American Bar Association; Fred D. Fagg, Jr., Chicago, managing director of the air institute, Northwestern University; Stephen Latchford, specialist on aeronautics in the treaty division of the State Department; Richard S. Oulett, Richmond, Virginia, legal expert, Aeronautics Branch, Commerce Department.

SPEED FOR NORTHWEST

Three Lockheed Orions, powered with supercharged Pratt and Whitney Wasps capable of cruising at 200 m.p.h. carrying passengers, mail and express on Northwest Airways northern transcontinental route. Duralumin flaps added to wood wings give low landing speed and load capacity 400 lb. greater than previous models.

Profits and sales

Consolidated net profit of the Cord Corporation for the fiscal year ending Nov. 30, 1933 amounted to $1,380 006, equal to 61 cents a share on 2 260 000 shares of $5 par capital stock outstanding. Current assets amount to $8,865,380 and current liabilities $711,460. During the year the management of Aviation Corporation and its operating subsidiary, American Airways, Inc., was assumed by the Cord Corporation. After several years of heavy losses, the Aviation Corporation this year will show a small profit. Management of the Smith Controllable Pitch Propeller Company was likewise assumed by Cord interests during the year.

The Lockheed Aircraft Corporation's earnings went sharply up during the third quarter of 1933, amounting to $20,282.70 after all charges slightly exceeding 11 cents a share of the 117,665 outstanding. This compares with net earnings of $28 117.23, after all charges for the first nine months of the current year, and contrasts with a deficit of $9 946.60 for the period from incorporation in June, 1932 to Dec. 31, 1932.

Plans of the Kellett Autogiro Corporation for 1934 include continuation of the production of the K-4 Kellett Autogiro recently granted an A.T.C. by the Department of Commerce, as well as other new models which may be developed. W. Wallace Kellett, president of the company, and R. H. Prewitt, research engineer, are at present in England studying recent developments of the de la Cierva autogiro.

E. B. Christopher, operator of Christopher Airplane Service at Wichita, Kan., is the new owner of the Swallow Airplane Company and will continue the manufacture of all Swallow planes. A new-type small cabin monoplane is scheduled for production.

A Douglas Dolphin Amphibion with special color scheme and luxurious interior fittings, is under construction for Monsieur Armand Esders, a French clothing manufacturer.

A Fairchild 22, Warner powered was sold by the Fairchild Airplane Sales Corporation to Charles A. Zwicky of Spain, who will use his new plane as a means of introducing and promoting the Fairchild line in that country.

An addition to the group of aeronautic interests in the RCA building at Rockefeller Center is the Manufacturers Aircraft Association, Inc., which has leased extensive offices there. Approximately 50 of the country's leading airplane manufacturers are represented in the association.

An enrollment of twenty-one new students, fourteen of whom signed for two year courses, is reported by Parks Air College Inc. at East St. Louis, Ill.

On the basis of an essay competition W. E. Boeing scholarships were offered again this year to American college undergraduates by the Boeing School of Aeronautics at the Oakland Airport.

Air defense

Consideration of aviation's role in our national defense set-up was resumed by the House Committee on Military Affairs of which John J. McSwain is chairman. The committee will direct itself mainly to deciding whether the present system should be continued, whether a separate air force with the status of a department should be created or whether a single department of national defense combining army, navy, air, would be the most effective. Beside the bill for the creation of a new air defense department (AVIATION, December, page 285), which has been referred to the Committee on Expenditures, Representative McSwain is pushing a bill for the extension of the present law requiring that the Chief of the Air Corps be a pilot as well as another bill which would recognize proprietory right to aircraft designs.

Among the major problems of a secretary of national defense, if one were created, would be the definite settlement of the eternally controversial issue of aerial coast defense, and of who is to handle it. The question which had been comparatively quiet for some time, flared up once again when the Army Air Corps sought seaplanes and amphibions.

The Bureau of Aeronautics, Navy Department ordered 21 Consolidated P2Y-1 flying boats which is the type that has been used on the Coco Solo and Hawaiian flights. The planes will be powered with two Wright Cyclones, of 700 hp. each. An order for 106 of these engines was placed with the Wright Aeronautical Corporation by the Navy. To date $5 200,000 of PWA's $7 500 000 allotment has been spent for planes, engines and accessories.

Thirty attack planes, 46 bombardment planes and 24 pursuit planes will be purchased by the Army Air Corps with its $7,500 000 PWA allotment. Included in these planes will be full Signal Corps and Ordnance equipment, spare parts, and spare engines.

Island airport

The agitation for an airport on Governors Island in New York harbor, five minutes from lower Manhattan, is being

revived by Mayor La Guardia. The War Department opposition continues.

Enduring young charms

To set a new women's refueling endurance record, Mrs. Francis Marsalis and Miss Helen Richey flew over Miami Municipal Airport for 237 hours, 40 minutes, 41 hours more than the old time set by Mrs. Marsalis and Miss Louise Thaden in 1932. They used a Curtiss Thrush plane powered with Wright Whirlwind 250 engine.

DeWoitine transport crashes

Flying through a wind and snow storm the tri-motor airliner Emeraude (AVIATION, November, 1933, page 358) broke a wing, fell and exploded near Corbigny, France, on its first long trip from French Indo-China. Several important officials were killed, including Pierre Pasquier, Governor General of Indo-China, M. Chaumié, director of civil aviation in the Air Ministry, M. Balazuc, director of technical services in the Air Ministry, M. Nogues, traffic manager of the Air Finance Company, M. Laurieu, attache of the Air Ministry, Captain Bussault, military aide of M. Pasquier, Madame Chaumié, and the crew were also killed.

The disaster marred the triumphal return of the Black Squadron from its African tour. (AVIATION, December, 1933, page 384).

Personnel

George E. Gardner, of Florida, who has been prominently identified with the aeronautical inspection activities of the Department of Commerce since 1928 has resigned his post as Chief of the General Inspection Service of the Aeronautics Branch to undertake a series of studies relative to scheduled air transportation. In this field Mr. Gardner has made outstanding contributions to the Department's regulatory work. Joseph T. Shumate of Indiana, former aeronautical field inspector, who was rerecently appointed Assistant Chief of the General Inspection Service, will succeed him.

Howard C. Stark, formerly blind flying instructor for Eastern Air Transport and author of "Blind or Instrument Flying" sailed Jan. 3 for Amsterdam to study night and instrument flying abroad. He will be connected with the Royal Dutch Air Lines.

Norvall B. Rader, of United Air Lines traffic staff in San Francisco was appointed assistant traffic manager of the New York City district.

Correction

In the table on page 19 of the January issue of AVIATION the figures for the rated brake mean effective pressure of the Hornet engine were in error. Reading downward in the last column, the corrected values are 164 and 160 instead of 134 and 164 respectively.

SIDE SLIPS

By Robert R. Osborn

AS WE have commented before, the airplane certainly has proved itself a disappointing means of "promoting amity between nations" which was the announced purpose of so many of the long distance flights which have been made. It does, however, seem to be a very effective instrument for promoting amity within families as we have an increasing number of married couples completing important flights. The most famous examples of this are the Lindberghs, of course, with the Mollisons of England, and the Ulms of Australia. Many other lesser known "Mr. and Mrs." are flying every day in the ordinary course of traveling, and we

shall soon have sufficient data to determine if the automobile custom of backseat driving has been successfully designed out of the airplane.

It seems to us that Americans, having always prided ourselves on being tough hombres, are likely to lose that title in the very near future unless we change our tactics a bit. While we are directing our attentions toward retaining that schoolgirl complexion, refusing to drink coffee unless it is dated, or has had the caffein removed, eating breakfast foods designed to give one "gentle" roughage in one's diet, and sleeping on mattresses which are—oh, so soft, other nations seem to be subjecting themselves to a thorough toughening process. Not so long ago we called your attention to a new British airplane, which as part of its acceptance test was landed in the water, although it was a landplane, was then run over by large ship to test in its seaworthiness characteristics. We were told that it stood up very well. Now, we read in *Flight* that an English manufacturer has "produced a wrist watch which is always tested for 24 hours under water before it is sold. They also claim that falls have no effect upon its workings, and, to give this claim a thorough test, the chief photographer of *Flight* was requested to take one of these watches up in an aeroplane and throw it overboard. The experiment was made over Brooklands aerodrome, and the watch, completely unprotected, was dropped from a height of 2,000 ft. It lay in wet grass for over an hour before it was picked up, and it was found to be still ticking merrily, and not even the glass was cracked. It has since continued to keep perfect time."

Of course we are not going completely effeminate. A year or so ago, one manufacturer tested his fountain pens by having them run over by Fifth Avenue buses in New York. Automobile manufacturers, if one can believe the advertisements, test their cars by running them over cliffs—and the owners are still testing them by running them into each other and into locomotives. Also, a little while ago, an inventor of an egg crate demonstrated it by dropping it from an airplane flying a few feet off the ground—although we have always thought that test demonstrated the strength of the eggs instead of the crate.

We see that the U. S. Navy is now painting the noses of experimental engines red as a warning to the pilot that he should investigate the special characteristics of that engine before making

a flight. This appeals to us as an excellent scheme and, as a red nose has always served as a warning for the human race we think its selection as a warning signal is certainly a natural.

We see that the British Air Ministry has recently put out a Notice to Airmen which calls attention to the fact that low atmospheric pressures or high temperatures have a bad effect on take-off and climb, and these effects can be reduced in effect by reducing the total weight of the aircraft. At the end of the notice the pilot is advised, "The total weight at which an aircraft is taken off should always be such that (a) the length of run required for the aircraft to unstick is not more than half the available runway in the line of flight, (b) the aircraft retains a reasonable rate of climb, and (c) the maximum weight laid down in the Certificate of Airworthiness is not exceeded."

While this is obviously good advice to the Airmen, we consider it incomplete, and therefore, suggest the addition of the following items: (d) the swearing on the part of the pilot is reduced to a minimum, (e) none of the passengers have to be revived after obtaining altitude, (f) none of the points of landscape beauty surrounding the airport, such as trees or high-tension wires, are disturbed in any way.

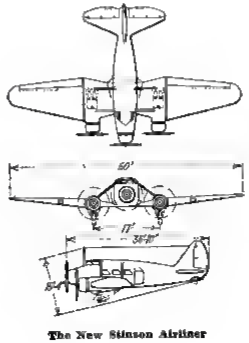
FLYING EQUIPMENT

The Stinson Airliner and the New Reliant

IN the November, 1933, issue of AVIATION (page 359), preliminary announcement was made of a new transport under development by the Stinson Aircraft Corporation. Although final details are not yet available, we are able at this time to add something to the previous discussion, including an outline drawing which shows its general arrangement. The intent of the designers has not been to produce a large machine of great carrying capacity for trunk line services, but rather to fill a definite need for "feeder" equipment to operate in conjunction with through schedules. Such machine will be used to make frequent stops at intermediate cities which cannot be served economically by larger airplanes. On certain foreign operations also high-speed equipment is required but passenger loads do not yet warrant the use of larger planes.

The use of three Lycoming Model R-680 BA engines (240 hp. each at 2,000 r.p.m.) is contemplated, giving a total output of 720 hp. At 5,000 ft. the ship is expected to cruise at 150 m.p.h. The substitution of engines of higher horsepower without change in the basic structure has been taken into consideration in the design. Smith controllable pitch propellers are to be fitted. An automatic pitch-shifting and synchronizing device has been developed.

Externally one of the most striking characteristics of the Airliner is a marked reduction of wing chord at the intersection with the fuselage. A very



The New Stinson Airliner

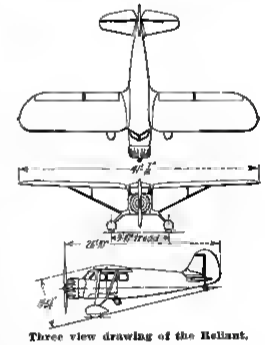
The new Stinson Reliant incorporates many features found in modern transport airplanes. Note the trailing edge flaps.

deep girder effect without excessive weight has been obtained by carrying part of the load across the fuselage through a pair of inclined struts on each side, extending from the nacelles to the upper longerons. The wing panels outboard from the nacelles are full cantilevered. A so-called "sesqui-spar" construction has been adopted. Except for metal aprons in the engine exhaust areas, the wings are fabric covered. The landing gear (including the tail wheel) is retracting. The wheels swing upward and forward into the under part of the nacelles—electrically operated.

A trailing edge flap extends across the center section from nacelle to nacelle. Ailerons run almost the full length of the outboard wing panels. Trimming tabs are fitted to the elevators, and the rudder is provided with a small flap to take care of the one-engine-dead condition.

Accommodations are provided in a well insulated cabin for eight passengers and a stewardess. The chairs are of the adjustable hammock type and individual heating, ventilating and lighting are provided. The cockpit can be arranged for one or two pilots. Standard flight and engine instruments are included, all of which are mounted on the instrument board in the cockpit. Sperry horizon and directional gyro are standard equipment. A Lux fire extinguisher system operated from the cockpit is also included. Complete two-way radio and mast and also four emergency landing flares are provided for as extra equipment. Cabin air-cooling and Goodrich de-icing apparatus may also be installed if desired.

The general specifications are: Span, 60 ft.; length overall, 36 ft. 10 in.; height overall (including radio mast), 15 ft. 4 in.; wing area (across fuselage), 500 sq. ft.; horizontal tail area, 105 sq. ft.; vertical tail area, 35 sq. ft.; weight empty, 5,670 lb.; payload (eight passengers, 1,360 lb.; and baggage and mail, 500 lb.), 1,860 lb.; gross weight, 8,750 lb.; wing loading, 17.5 lb. per sq. ft.; power loading, 12.2 lb. per hp.



Three view drawing of the Reliant.

IN LAYING OUT the latest Reliant, Stinson engineers have made every effort to make available to private owners an airplane which incorporates not only the technical features of the modern transport, but also the comforts and economies of the modern automobile. The usage of a rubber mounted engine, electric starter, thirteen-plate twelve-volt storage battery, trailing edge flaps, hydraulic brakes, rubber mounted instruments, and V-type windshield, all reflect current transport practice. Cabin insulation against heat and noise, and a complete heating and ventilating system which permits the regulation of air entering the cabin to any desired temperature, are also airliner features. The arrangement of the cabin with its upholstery, furniture and fixtures derives directly from the automotive field.

Externally, although the kinship to

earlier Reliants is unmistakable, improvement in many details is evident. Fairings which were formerly considered as extras, now appear as standard equipment. The close-fitting N.A.C.A. cowling and the new V-type windshield materially improve the lines of the fuselage. Large fillets at all intersections carry the body line smoothly into the wing and tail surfaces and undoubtedly contribute to gains in performance. The high wing arrangement has been retained, but by reducing the wing sections at the root a "gull-wing" effect has been produced which is pleasing to the eye and which offers certain aerodynamic benefit. The wing span has been reduced somewhat as compared to previous models, and as indicated above, trailing edge flaps have been incorporated between the ailerons and the fuselage. The flaps permit a selection of gliding angles over a wide range, and permit short landings in small fields over relatively high obstructions.

The landing gear is of the so called "pursuit" type with Aerol shock absorbers built into heavy cantilever struts. Air Wheels equipped with disk-type hydraulic brakes are standard. Mudguards are regularly fitted, "pants" are optional.

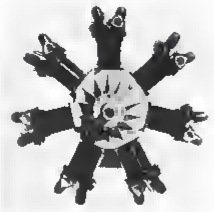
Behind the cabin is a large baggage compartment which may be reached either from inside or outside. When the outside door is open, a light in the compartment is automatically turned on, a feature useful at night or in dimly lit hangars.

The new Reliant with its 225 hp. Lycoming engine has a top speed of 138 m.p.h., cruises at 120 m.p.h. The overall dimensions are shown on the outline drawing. The weights are as follows: empty 2,150 lb.; gross 3,225 lb. The useful load includes pilot 170 lb., three passengers 510 lb., 50 gal. of gasoline 300 lb., 4 gal. of oil 30 lb., baggage allowance 65 lb.

A New Plane and a New Engine by Kinner

THE PAST few weeks have witnessed the launching of two new products from the Kinner plant at Glendale, Cal.—the first, an airplane, the "Sportwing," the fifth of a series of low-wing monoplanes to receive Department of Commerce approval; and the second, a new engine which in several significant respects departs from the usual Kinner practice.

The "Sportwing" is similar in general appearance to its predecessors, but by clipping the wing span somewhat and stepping up the power, its performance and maneuverability have been improved. Where the older model listed a top speed of 110 m.p.h., the new machine has been clocked at 118. It



Latest Kinner power plant, the C-7 of 300 hp.

carries sufficient fuel to cruise for four hours at 105 m.p.h. The power plant is a model B-5 Kinner engine of 125 hp.

The welded steel tube fuselage is faired out to an oval section and fabric covered. The wing stubs which carry the landing gear and form points of attachment for the outboard wing panels are also of welded steel tubing and built integral with the fuselage proper. The wing panels are built up of solid spruce spars with steel tube compression struts and double drag bracing. Ribs are of wood and the whole is fabric covered. Ailerons are also of wood and are of the tapered chord type incorporating frieze balance and differential control.

Tail surfaces are of welded steel braced externally with streamline tie-rods. Stabilizer is adjustable from the cockpit. The landing gear is of the conventional divided type. The shock units are Kinner-built. Airwheels fitted with Timken roller bearings are regular equipment. A tail wheel is provided.

The cockpit is arranged for side-by-side seating with dual control. A weatherproof cover may be fitted at extra cost. Large baggage compartments are available in each wing stub. The usual engine and navigation equipment is furnished and wooden propeller is standard equipment.

General specifications are: span, 34 ft. 5 in.; length overall, 24 ft. 2 in.; height, 7 ft. 2 in.; wing area (including ailerons), 174.25 sq.ft.; weight empty, 1,197 lb.; payload, 279 lb.; gross weight, 1,875 lb.; wing loading, 10.76 lb. per sq.ft.; power loading, 15.0 lb. per hp.

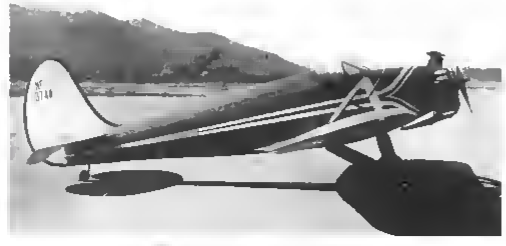
TURNING to the engine, we find a marked variation from Kinner tradition as established by the well-known K, B, and C series. Heretofore the Kinner activities have been limited to radial engines with five cylinders only. In the new C-7, two extra cylinders have been added and the horsepower rating boosted to 300. For the first time also a power induction system has been included. On the 300-hp. model an 11-in. impeller running at engine speed is installed but provision has also been made so that by introducing the necessary gears, applying a General Electric type impeller and changing the carburetor it will be possible to supercharge the engine to approximately 420 hp. at 1,800 r.p.m. and 500 hp. at 2,200 r.p.m.

The cylinders and pistons in the C-7 are very similar to those employed in the C-5 model. Some change has been made in the finning however and the rocker box housings have been cast integral with the head to reduce the possibility of oil leakage. The rocker arms have roller bearing axles and are so designed that lubrication of the rocker arm main bearings also takes care of the top end of the push rods.

The crankshaft is of the two-piece type which makes the use of a one-piece master rod possible. The shaft is carried on three main bearings of the anti-friction type. Link rods are similar to those used in the C-5 engine.

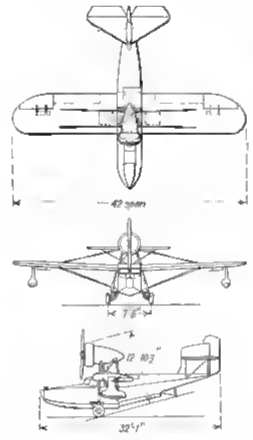
The valve mechanism differs also from that of previous Kinner models in which each pair of valves have been operated from a short individual camshaft set in the crankcase and gear-driven from the crankshaft. The C-7 is equipped with a three lobe cam ring which runs at one-sixth engine speed and is mounted in the rear half of the crankcase just ahead of the blower section.

The crankcase is built in two main sections, the power section in the front and the manifold and accessory section in the rear. The front section as usual, takes care of the crankshaft bearings,



The Kinner Sportwing, a new two-seater.

As the artist sees the new Fokker F-22.



The new Loening Commuter in outline.

the cylinders, etc., and the rear section provides for the supercharger and accessories. The nose section is equipped with a valve mechanism for operating hydraulic controllable pitch propellers. The accessory drives (which include provision for two magnetos, electric starter, generator, fuel drive pump, vacuum pump, air pressure pump, two gun synchronizers and one tachometer) are driven from an extension of the crankshaft behind the supercharger section. A Stromberg NA-R9A carburetor and Scintilla magnetos are standard equipment. The oil system is of the static pressure type with pistons and piston pins lubricated by splash in the customary manner. It has been laid out with an eye toward the elimination of long oil passages in the crankcase. The scavenger pump is of the three-gear type and provision is made on the pressure pump for a Cuno oil filter.

The crankcase has been designed for the mounting of N.A.C.A. or other cowling. The engine is so arranged that magnetos can be replaced with battery ignition units. Radio shielding is optional.

The general specifications are as follows: rated horsepower, 300 at 1,800 r.p.m.; number of cylinders, 7; bore, 5⅜ in.; stroke, 6 in.; displacement, 1,044 cu.in.; compression ratio 5.25 to 1; crankshaft No. 30 S.A.E. standard; dry weight (without carburetor, air heater, exhaust collector ring, starter or propeller hub but including hub-nut) approximately 575 lb.; overall diameter 51⅝ in.; overall length, 44½ in.; mounting bolt circle, 20-in. diameter.

Loening's Newest Commuter

FOR the first time in some 20 years of building airplanes for other people, Grover Loening has turned out a new design primarily for his own personal use. He and Mrs. Loening, also a licensed pilot, will use the new amphibian as a means of commuting and for pleasure cruising.

The new ship is a direct descendant of the well known Loening Commuter biplane, but it shows some 30 m.p.h. increase in top speed for the same landing speed. The usage of a monoplane wing system with split trailing edge flaps contributes materially to this improved performance.

The overall features are apparent from the accompanying three-view drawing. Seats are provided for four people in the cabin. The ship weighs 3,100 lb. empty, carries 1,200 lb. useful load. The wing span is 42 ft. and the area 280 sq.ft. The ailerons are of the latest type investigated by the National Advisory Committee for Aeronautics with relatively short span and long chord moving through differential angles much higher than those heretofore used. The power plant is a Wright J6 Whirlwind of 300 hp.

The F-22 Fokker Transport

ALTHOUGH the ship is still under construction and complete details are lacking at the moment, we are able to show herewith a preview of the Fokker F-22 airplane which has been ordered for European and Colonial services by both K.L.M. and A.B. Aerotransport. The machine is designed for a gross weight of 28,100 lb. including 22 passengers, a crew of four, and a total baggage and mail cargo of 11,350 lb. Four Pratt & Whitney T1B1 Wasp engines of 525 hp. each mounted in the leading edge of the wing, furnish the power. The approximate dimensions of the ship are given as 100 ft. span and 71 ft. length overall. Fuel capacity is in the neighborhood of 700 U.S. gal. and the design has been calculated to maintain 9,200 ft. altitude with full load and any one engine out of the running.

The cockpit arrangement is novel. The first pilot sits well forward in the nose where he has a very excellent view all around. The second pilot is located behind and to the right, and somewhat lower to the left the radio operator will sit facing aft. One baggage compartment is located under the nose another toward the tail. Behind the cockpit is a compartment for the steward, and the cabin proper is divided into four compartments with the usual washroom and wardrobe equipment aft. The landing gear is not retracting, but is well streamlined.

Potez 50. Altitude Record Holder

THE POTEZ 25 T.O.E. general purpose biplane is a familiar sight on many a military airdrome in Europe.

The special Potez 50 in which Gustave Lemoine set a new altitude record.

Some 3 500 machines of this type have been built and sold to air forces throughout the world During the latter part of 1931 a modification of the basic type, the Potez 50-A 2 appeared Many of the characteristics of the old 25 were in evidence but the original 450-hp Lorram water-cooled engine had been replaced by a new 700-hp Gnome-Rhone 14-Kbrs radial air-cooled engine Certain changes were also made in the wing cellule, including a revised wing section and a rounding up of the tips A full N A C A cowl was fitted over the engine and the entire design was cleaned up aerodynamically

For an assault on the altitude record held by England's Cyril Uwins (successfully accomplished by Pilot Gustave Lemoine on Sept 28 1933, when he pushed the mark up to 44 819 ft) the regular Model 50-A 2 was further modified The span of the upper wing was increased from 48 ft 6 in to 61 ft, boosting the total wing area from 452 sq ft to about 575 sq ft The wing loading was thus reduced from about 11 lb per sq ft to about 7 2 lb per sq ft At the absolute ceiling, after having consumed some 430 lb of fuel during the ascent, the wing loading was approximately 6 5 lb per sq ft

Other changes in high altitude ship involved the elimination of the observer's seat and the substitution of a highly supercharged Gnome-Rhone 14-Kbrs engine fitted with a large diameter Gnome metal propeller of fixed pitch All engine cowling was removed for the flight

The general characteristics of the airplane at the time of the altitude flight were as follows Maximum span, 61 ft , length overall, 30 ft 9 in height overall, 11 ft, 10 in , weight empty (with normal equipment), 3 350 lb , weight of fuel and oil 502 lb weight of pilot, plus parachute clothing heaters, oxygen equipment barograph etc , 298 lb , gross weight at take off 4 150 lb

MARINE AIRCRAFT DESIGN, *by William Munro Putnam Publishing Corporation New York and London 1933 230 pages $4 50*

A GREAT deal of ground can be covered in a fashion at once clear and complete within the space of 230 pages if one knows how to set about it Mr Munro has known exactly how, and his book is an admirable one for every designer's library and for careful study by every budding aeronautical engineer Written principally from the point of view of the naval architect, but never overlooking the specifically aeronautical nature of the problem, he covers the calculation of float or hull size the effect of form on resistance, the method to be used in calculating stresses both in hulls and in floats, and the details of structure in a number of different systems of construction All these subjects are treated better than any book has ever treated them before The section on stability of boats on the water is remarkable for making use of the imposed upsetting moment required for complete submergence of the wing float as a criterion of wing float size (as in the method developed by the writer of the present review, and published by the N A C A some ten years ago) in place of the fallacious and sometimes dangerously misleading method of using float factor of safety" that has been too commonly recommended in American texts

Among the other virtues of Mr Munro's treatment is the display of an exceptionally thorough acquaintance with American practice, considered and compared with British customs and rules in a fashion that ought to be most enlightening to designers in either country A striking difference in step location with an American tendency to locate the step much farther aft than British practice recommends is emphasized The only defect from the American point of view is the total absence of any specific study of the single-float seaplane, a type of course quite unknown in England. The twin-float arrangement, both for general service and for racing gets a very full treatment

The chapters dealing with hulls and floats are supplemented by a chapter on wing design contributed by B S Shenstone, who analyzes at length the various types of structure that have been tried and the reasons for preferring one or another in particular cases Like his co-author, Mr Shenstone shows an almost complete absence of prejudice and especially of the traditional British prejudice in favor of biplanes for most purposes We pay his contribution a high compliment in saying that, though its brevity makes it necessarily somewhat incomplete, so far as it goes it is quite worthy of the volume in which it appears

FINANCIAL POLICIES IN THE AVIATION INDUSTRY, *by Paul A, Dowd A thesis in economics at the University of Pennsylvania, Philadelphia, 1933, 230 pages*

THIS is a book for which there has long been urgent need, and a reviewer's first emotion is regret that it has not been published in a form that will make it more readily available to a wide circle of readers It ought to be studied by every young man who has recently entered the aeronautical field or who plans to go into it with the hope of ultimately becoming an executive It ought to be read by every actual or would-be investor in aeronautical securities, and by every broker who is called upon to advise his clients on their purchases of industrial stocks. Elaborate documentation and the insertion of many tables make the going a little heavy at times, but the volume repays the study that it demands Of course no effort has been made to check all the innumerable statements of fact for which Mr Dowd has made himself responsible, but the general impression is of a rather remarkable degree of freedom from error and particularly of a remarkable success in avoiding the twin perils of undue pessimism and of undue buoyancy Mr Dowd is by no means subject to the illusions that were so prevalent in 1929 and he sees plenty of economic problems in the path of the industry but he is lavish with suggestions of the ways in which problems may be solved or may even solve themselves We say again and with emphasis, a good book

THE AMERICAN TRANSPORTATION PROBLEM, *Charles G. Moulton and Associates, the Brookings Institution Washington, 1933, 915 pages $3*

THIS is the record in book form of the research work done by Dr Moulton and his associates for the National Transportation Committee presided over by the late President Coolidge A notable collection of material, it is no mere statistical compilation but a book so written that it will stand the test of steady cover-to-cover reading Naturally, in view of the conditions of the appointment of the Transportation Committee the major portion of the material collected was concerned with the railroads, and the railroads occupy approximately a half of this volume Aviation gets only about 50 pages a brief but careful survey prepared under Dr Moulton's supervision by Dr. P T David. Beginners in the study of air transport economics will find the treatment interesting Veterans in the field will discover in it nothing that is particularly new to them, but even the most expert and best informed of air transport operators ought to be interested in reading "The American Transportation Problem" as a whole and comparing the report of experience and the present position of other forms of transportation with those of the special brand with which he is most concerned From the point of view of the financial results made good and of public favor received in a time of depression the airlines need have nothing to fear from the comparison

AERONAUTICAL LAW, 1933 SUPPLEMENT, *by W Jeffersen Davis, Parker Stone & Baird Company Los Angeles, 1933 215 pages*

DR DAVIS' work, so well known to lawyers, hardly needs review In this supplement to the original volume, bringing it up to date, the writing has been even more concise and more specifically directed to the attention of the legal profession than in the original publication which appeared some years ago It differs from many legal text in that its function is not merely to explain, but also to argue The first of the three parts of which the book is composed is devoted to the law fixing the responsibility of air carriers and to the development of the author's plea that the doctrine of res ipsa loquitur (which may be roughly translated into English as meaning that whenever an airplane accident happens there must have been negligence because without negligence there wouldn't have been any accident) is unsound and unjust in application to aviation It is a very strong argument which every lawyer who ever has handled or who expects to handle aviation cases will read with interest The second part deals with trespass and nuisance, and especially with the application of those terms to fixing the legal position of an airport The third part gives a brief digest of recent cases, arranged by subject matter The treatment is of course much less complete than in those classic compilations the U S Aviation Reports, but the selections of citations have been good and their very brevity makes it easy to pick out the key points in the key decisions

INLAND TRANSPORTATION PRINCIPLES AND POLICIES, *by Sidney L Miller, McGraw-Hill Book Company, New York, 1933, 822 pages, $4*

PROFESSOR MILLER surveys the field of transport with a conscientious determination to omit nothing He starts at the point where the Neanderthal man began to carry loads on his back instead of dragging them along the ground, and he comes straight down through all the intermediate stages to last January's report of the National Transportation Committee and last May's enactment of the Emergency Transportation Act as one of the tentacles of the New Deal The book is pre-eminently a story of the railroads their economic development, their methods of operating their services, and the legal control to which they are subjected, and it is of interest to the air transport man principally for comparative purposes and for the possible analogy between the past history of the railroads and the course of future events in his own field Motor transportation receives some 60 pages, however, and waterways about as much, and aviation one brief chapter—sufficiently competent as a guide to the layman, but not particularly original or elaborate Despite the limited space given to air transport, the author regards it with obvious sympathy and is very confident of its bright future

THE MATERIALS OF AIRCRAFT CONSTRUCTION, *by F. T. Hill, Pitman Publishing Corporation, New York and London, 1933, 362 pages, $4 50*

A GOOD general text on aircraft materials, covering the whole range impartially, has long been needed. From the point of view of the American designer, Professor Hill's book will not supply the need. It is a competent collection of material on a considerable number of different types of materials and upon the various mechanical treatments to which they may be subjected but it falls far below the standard of the British official "Report on Materials Used in Aircraft" of twelve years ago The present volume, in fact, draws very largely upon the earlier one for its content. Illustration is scarcely adequate, the style, though clear, is unattractive and the American reader will be handicapped by the general use of British standard specification code numbers in place of chemical analyses for alloys

L'AVIATION ET LE DÉSARMEMENT, *by Roland Bechoff Les Editions Internationales Paris, 1933, 132 pages $1 25 approximately*

THIS book is a general historical review of the efforts made in the last few years to find some device for limiting the development of military air power and the aerial competition between the nations Dr Bechoff reports on all views and all plans, giving particular attention to the present strength of air forces and to the question of internationalization of civil aviation Keeping his own opinion somewhat in the background, he nevertheless lets it become evident that he is very doubtful of the prospect of any very significant agreement along the lines so far followed, and particularly doubtful about the benefits of the plan of internationalization which has been so much discussed in Europe for the past year and which has commanded so much sympathy in France

COMMUNICATION AGENCIES AND SOCIAL LIFE, *by Malcolm M. Willey and Stuart A Rice, McGraw Hill Book Company, New York, 1933 229 pages, $2 50*

ONE of the long series of impressive monographs prepared under direction of the President's Research Committee on Social Trends, this covers every form of transportation from the motorcycle to the Pullman and the airplane, with incidental digressions into the postal service, telephone and telegraph, newspapers, motion pictures, and broadcasting Air transportation gets only a dozen pages, and the treatment is of a very casual order It would do very well for the complete outsider who wanted to know a very little about air transport in relation to transportation of other types, but for those who have already been sufficiently interested in this subject to become readers of AVIATION, and especially for readers who studied the March Record-of-Progress issue, the aeronautical section of Messrs Willey's and Rice's volume will contain nothing new Aeronautical readers will perhaps be more interested in the sections dealing with the development of the railroads and of other competing transportation forms for they may find there some suggestions about the probable course of their own future

INTERNATIONAL AIRCRAFT REGISTER *1933, Paris, 730 pages, $20 approximately, distributed in America by the American Bureau of Aircraft (New York), editors of the American section*

THE customary annual register of the world's civil aircraft appears with America's better represented than ever before, but with the British Empire missing All American planes owned by transport companies, to the number of 545, are tabulated with a complete listing of their major characteristics For the European countries, where the total numbers of civil aircraft are not so formidable, the listing includes privately owned machines as well, to a total of 1 612 from France, 999 from Germany, 644 from Italy, 101 from Japan, etc. A total of some 5,000 planes are covered. It is a bulky book and not a very exciting one, but an extremely useful reference for any one who wants to keep abreast of the world's distribution of aircraft

THE BUYERS' LOG BOOK

AVIATION'S *Card Index of New Equipment*

This department is equipped to help readers locate manufacturers of any parts, accessories or materials

ACCESSORIES — **Camera, aerial**

Fairchild Aerial Camera Corporation, Woodside, L. I., N. Y.

A COMPACT, low priced (under $200) aerial camera being distributed by Fairchild. Negative size 3¼x5½ in. Variable tension focal plane shutter, 1/10 to 1/1000 sec. Lens F4.5 of Tessar type with 9½-in. focal length. Uses film pack, cut film or plates. Filter equipment available. Two hand grips. Dimensions (except for handles) 6x8x15 in. Weight under 15 lb. Suitable for ground use.

AVIATION, *February, 1934*

ENGINE ACCESSORIES — **Gas primer**

Standard Oil Company of New Jersey, Inc., New York, N. Y.

EQUIPMENT for starting airplane engines in cold weather by direct injection of propane gas into the intake manifold offered, including portable tank, reducing valve, hose and injection "pistol." Simple bayonnet attachment permanently fitted to engine manifold for pistol connection. Self contained units for permanent installation on airplanes also available.

AVIATION, *February, 1934*

INSTRUMENTS — **Catalog**

Kollsman Instrument Company, Brooklyn, N. Y.

NEW catalog "Kollsman Precision Aircraft Instruments" received containing an account of the company's background, a description of its manufacturing and testing facilities, and a complete and detailed listing of its products. Weight schedules and installation diagrams are given for each instrument. Loose-leaf form, in heavy paper covers. The catalog is available on request.

AVIATION, *February, 1934*

PARTS — **Bearings (Catalog)**

The Timken Roller Bearing Company, Canton, Ohio

A REVISED edition of the Timken Engineering Journal is now available. In loose-leaf form in a substantial 3-ring binder, the book contains some 250 pages of technical and engineering information on bearing problems in general, and also includes complete description of the various Timken products together with tabulated data on ratings, load calculation, selection and maintenance.

AVIATION, *February, 1934*

RADIO — **Airplane receiver**

Westport Manufacturing Company, Glendale, Cal.

WESTPORT Junior Model AR40 designed specially for private airplane installations is a compact 4-tube superheterodyne receiver covering weather, radio range and entertainment frequency bands (200-410 kc. and 540-1500 kc. available by selector switch). Direct operation, weighs 4½ lb. complete. size—6½x6⅝x4½ in. Operates from 12 v. "A" and 144 v. "B" batteries.

AVIATION, *February, 1934*

RADIO — **Airport receiver**

RCA Victor Company, Inc., Camden, N. J.

A NEW eight-tube superheterodyne radio receiver has been announced which covers a frequency range from 150 to 18,000 kc's in five bands. Airways weather, aviation communication, police reports and foreign and domestic entertainment broadcasts can be handled. Self contained with built-in loudspeaker, illuminated airplane type dial. For 110-220-volt 60 cycle current. 21⅞x14⅛x10⅛ in.

AVIATION, *February, 1934*

RADIO — **Direction finder**

Washington Institute of Technology, Washington, D. C.

DIRECT-AIRE Model 33-A direction finder developed to simplify navigation for private owners and sportsman pilots. Direct operation from any aircraft radio receiver. Loop antenna used. Permits pilot to fly direct course to any commercial, government or marine radio station that can be tuned-in. Dial indicated "on course" positions. Dimensions of receiver unit—4½x6½x8½ in.

AVIATION, *February, 1934*

SHOP EQUIPMENT — **Paint spray gun**

Electrical Painting Equipment Company, Inc., 247 Park Avenue, New York, N. Y.

THE Norris Airless Painting Machine uses centrifugal force to atomize paint and other liquids instead of compressed air. Paints to a sharp line without producing paint fog. Self-contained, hand-held unit incorporates paint supply, electric motor and spray control. Operates from 110 volt (220-volt machines special) AC or DC power supply. Weighs 5½ lb. and may be packed in small space.

AVIATION, *February, 1934*

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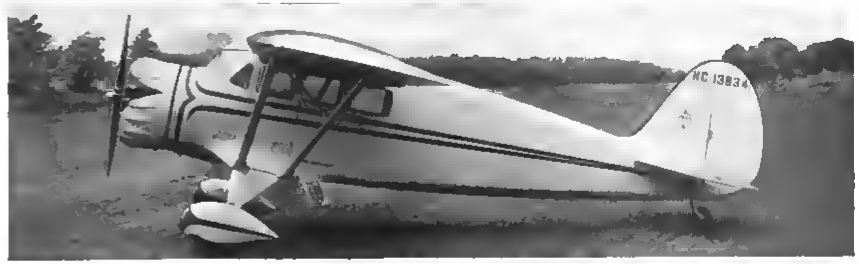

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By flying more than 60 million miles on single engine and tri-motored planes in the United States, Alaska, South and Central America, Europe, the Philippines and other countries, the Lycoming Transport engine has been proven *MORE RELIABLE* than any motor of its power class.

Now in 1934

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Offering many new mechanical features and comforts previously found only in Airline Transport planes, or in planes in the $10,000 price class, the New 1934 Stinson Reliant, four-passenger cabin plane provides the utmost in reliable cross-country transportation, with the safety and precision of the modern Airliner, and at operating costs comparable to motor car travel.

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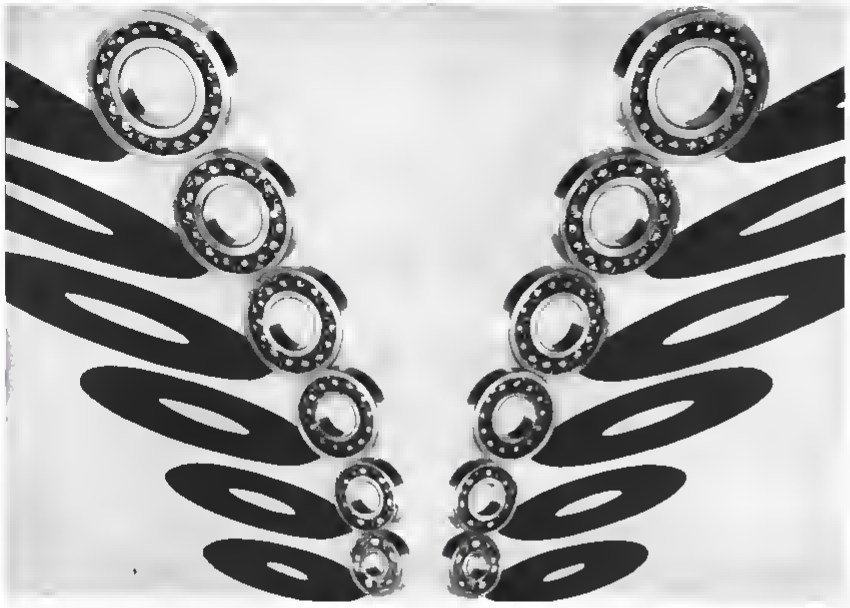

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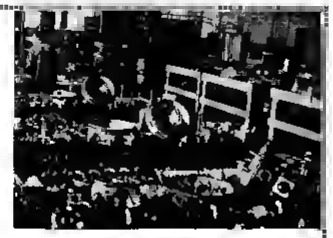

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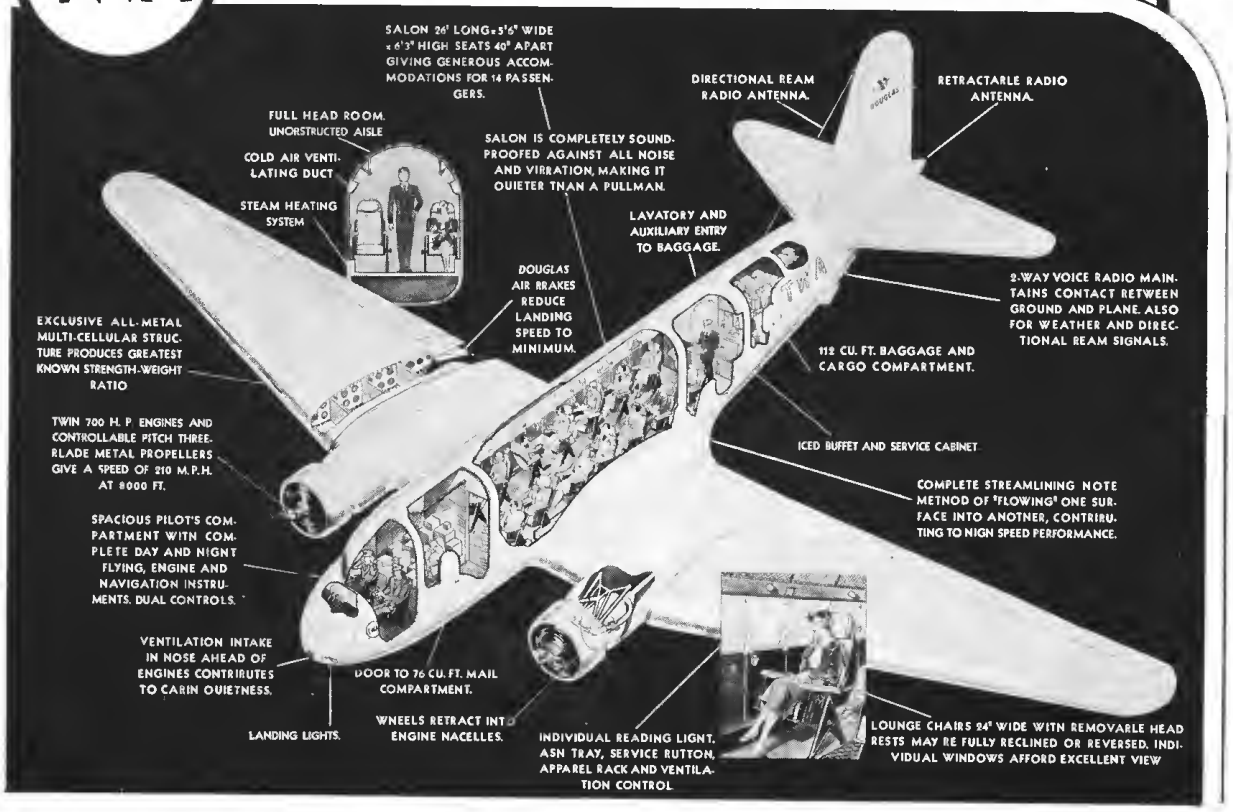

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